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Philadelphia College of Osteopathic Medicine

Department of Psychology

EDUCATORS' KNOWLEDGE OF AND ATTITUDES TOWARD CONCUSSIONS AND THE NEW JERSEY CONCUSSION LAW

By Einat Katz-DeLong

Submitted in Partial Fulfillment of the Requirements for the Degree of

Doctor of Psychology

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PHILADELPHIA COLLEGE OF OSTEOPATHIC MEDICINE
DEPARTMENT OF PSYCHOLOGY

Dissertation Approval

This is to certify that the thesis presented to us by **Einat Katz-DeLong**

on the **13th** day of May, 2014, in partial fulfillment of the requirements for the degree of Doctor of Psychology, has been examined and is acceptable in both scholarship and literary quality.

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Abstract

Recent media attention, lawsuits from retiring athletes, and the early retirement of famous athletes have increased public awareness of sports-related head injuries. High school student athletes are more susceptible to concussions than older athletes. Athletes suffering from concussions may experience long-lasting effects on their lives, particularly in cognitive, emotional, and school functioning. Given the increased rates of concussions and their ramifications, state governments and the federal government have taken action. Beginning with the start of the 2011–2012 school year, the state of New Jersey has implemented legislation that requires all school districts with interscholastic sports programs to develop a written policy concerning the prevention and treatment of sports-related concussions. Since the enactment of this legislation, no research, to date, has been conducted on the attitudes and knowledge base of superintendents and principals regarding concussions and/or concussion law. Results from this study revealed that educators have increased their knowledge regarding the causes of concussions and the physical symptomology of concussions; however, they still lack an understanding of the emotional sequelae associated with them. Additionally, it was found that many school districts are not in compliance with the NJ Concussion Law two years after its implementation. Educators have reported numerous barriers in implementing the law, such as budgetary limitations, staff limitations, and lack of uniformity amongst the 603 school districts. Results from this study could be utilized by the Brain Injury Alliance of New Jersey as well other associations in order to complete a robust educational program for school educators that would help to fill in the deficits gaps.

Keywords: concussions, concussion law, attitudes, knowledge, educators

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Introduction

Statement of the Problem

The neuropsychology of sports-related brain injury is a new and developing field, characterized by the assessment and treatment of the cognitive and emotional sequelae secondary to concussive injury (Erlanger, Kutner, Barth, & Barnes, 1999). According to the Centers for Disease Control and Prevention, there are as many as 300,000 sports-related concussions in the United States each year (Thurman & Guerrero, 1999). For children under the age of 15, sports accidents are the leading cause of medically attended brain injury, exceeding motor vehicle accidents by two fold. There are an estimated 900 deaths per year in sports and recreational activities due to any injury to the brain (Erlanger et al., 1999). Because of the physical nature of contact sports (e.g., soccer, ice hockey, and American football), athletes participating in these sports are much more susceptible to suffering a concussion than athletes who do not participate in such sports (Solomon, Johnston, & Lovell, 2006). Recent media attention, lawsuits from retiring athletes, and the early retirement of famous athletes have increased the public awareness of sports-related brain injury.

Researchers have struggled to operationally define the term concussion. Currently, the most accepted definition of a concussion is a "traumatically induced alteration in mental status that may or may not involve a loss of consciousness" (Kelly & Rosenberg, 1998, p.55). The symptoms of concussions are thought to lie on a continuum from mild to severe. The most common symptoms associated with concussions are: headache, fatigue, drowsiness, increased sadness, feeling slowed down, loss of balance, nausea, insomnia, trouble falling asleep, confusion, disorientation, irritability, numbness,

or tingling (Lovell & Collins, 2004). Confusion or memory loss is considered to be a hallmark symptom of concussion (Konots, Collins & Russo, 2005). Researchers have concluded that the most common, immediate signs of sports concussion are: (a) appearing dazed or confused, (b) being confused about the play, (c) forgetting plays, (d) clumsy movements, (e) slow response time to questions and, (f) uncertainty about the score or the opponent. Typically, the symptoms of a concussion spontaneously resolve within 7 to 10 days (Iverson, 2005).

Johnston, McCrory, Mohtadi and Meeuwisse (2001) observed 44 collegiate ice hockey players over a span of 2 years. During the study, Johnston and her colleagues observed that headaches, dizziness, fatigue, visual disturbance, and noise and light sensitivity were the most prevalent physical symptoms following a concussion. The researchers also observed that the most common cognitive symptoms were memory deficits, attention/concentration deficits, and executive function deficits. In addition, they also observed that depression, anxiety, and irritability were the most common emotional symptoms.

There are concerns that exist for athletes who receive multiple concussions over a short period of time. Some believe that this may present an added danger, because an initial concussion may leave the brain in a vulnerable state for a period of time. Therefore, injured athletes must be prohibited from returning to play prior to the resolution of their symptoms (McKee et al., 2009). Strict return to-play guidelines are important in order to avoid risk of cumulative effects such as decline in mental function (Collins, 2001). Concussions account for nearly 10% of sport injuries, and are the second leading cause of brain injury for young people ages 15 to 24 (McKee, 2010).

It is also important to diagnose a concussion properly and ensure that the athlete does not return to play prior to the resolution of his/her symptoms because of a condition called Second Impact Syndrome (SIS). This occurs when an athlete who has sustained a brain injury/concussion sustains a second brain injury/concussion before symptoms associated with the first brain injury/concussion have resolved. Bailes and Cantu (2000) estimate an SIS mortality rate approaching 50%; other patients are left with severely disabling conditions at nearly 100%. However, it is important to note that this condition is considered to be extremely rare.

A more common disorder associated with concussions is Post Concussion Syndrome (PCS), which is defined as any potentially permanent symptoms from a single episode or a chronic history of brain injury that lingers beyond a few weeks after the injury (Collins & Hawn, 2002). Many retired football players have PCS. In addition, repeated concussion increases the likelihood that the athlete will later in his life develop neurological disorders, such as Parkinson's disease and Alzheimer's disease (Collins & Hawn, 2002). Chronic Traumatic Encephalopathy (CTE) refers to chronic cognitive and neuropsychiatric symptoms associated with unique degeneration of brain tissue and a build-up of the abnormal protein "tau" in athletes who have a history of repeated episodes of mild traumatic brain injury (McKee. et al., 2009).

Due to the nature of sports concussions, the variability in understanding of concussion and its lasting implications, Senator Robert Menendez of New Jersey introduced the Concussion Treatment and Care Tools Act of 2009 in the United States Senate. The law would have required the Secretary of Health and Human Services to develop federal concussion management guidelines within 2 years of passage and would

have given federal grants to states if they committed to disseminating and ensuring the implementation of the guidelines by elementary and secondary schools. A version of this bill was passed by the U.S. House of Representatives on September 30, 2010 but was never passed by the Senate.

However, many states have passed their own laws to address this burgeoning public health problem. As of January 2014, all 50 states and the District of Columbia have adopted youth concussion laws. The Concussion Law of New Jersey was passed in 2010, and became effective on September 1st, 2011; this law contained mandates to help monitor and evaluate sports concussions (Brain Injury Alliance of New Jersey, 2011). The law requires that the New Jersey Department of Education develop and enforce a brain injury prevention and safety training program for all school personnel. The law also requires that school boards adopt a policy that, at a minimum, has the following components: guidelines regarding removal of a student from athletic completion following a concussion, a description of the appropriate criteria to delay the return to athletic competition, and the completion of an interscholastic brain injury training program by all coaches, school nurses, school/ team physicians and licensed athletic trainers.

Purpose of the study

The purpose of this study is to evaluate the knowledge and attitudes of superintendents and principals regarding the new concussion law in New Jersey. School concussion management policies should reflect the most current information available on the prevention, the risk, and the treatment of sports-related concussions and other head injuries. It is essential to study the implementation of the law in order to ensure the safety

of student athletes and to decrease the chances of lasting implications of sports related concussion.

The present study is seeking to evaluate the attitudes and knowledge of superintendents and principals about concussions, including the implementation of the different components of the law in New Jersey. A primary goal of the proposed study is to gain a better understanding of the challenges that are faced not only by New Jersey school districts but also by other school districts that are attempting to implement similar laws in the future. In addition, the Brain Injury Alliance of New Jersey can create a more robust and proactive program of concussion education for school administrators based on the results of this study.

Literature review

"Once the game is gone it doesn't mean that your concussion symptoms are gone. You still have a long life you need to live, and I'm living proof of that."- Keith Primeau

Introduction to Concussions

According to the Brain Injury Association of America (2010), traumatic brain injury (TBI) is the most frequent cause of disability and death among children and adolescents in the United States of America. Approximately 300,000 sports-related brain injuries occur on a yearly basis (Thurman & Guerrero, 1999). Repeated, mild brain injuries over an extended period of time could result in neurological and cognitive deficits (Center for Disease and Prevention Control, 2005). Due to these potential long-term ramifications and the increasing rates of concussions, lawmakers have proposed federal and state laws in order to protect the well being of student athletes.

Literature relevant to the implementation of the concussion law in New Jersey and the potential dangers associated with not implementing such laws will be reviewed. Brain anatomy and the brain's vulnerability to concussion, the impact of Post Concussion Syndrome (PCS) and the risk of even more debilitating conditions, such as Second Impact Syndrome (SIS) and Chronic Traumatic Encephalopathy (CTE) will also be reviewed. It is extremely important to understand the effects of concussion on the brain, because the type of injury and the magnitude of the injury could lead to particular cognitive or neurological deficits, which in turn impacts return-to-play decisions.

Concussion in high-school athletes

McKeveer and Schatz (2003) have reported that more than 5% of high school athletes sustain concussions each year while participating in interscholastic sports. Numerous studies have reported that the occurrence in high school athletes is more frequent than in older athletes (Lovell, Collins, Iverson, Johnston, & Bradley, 2004; Webbe, & Barth, 2003). Webbe and Barth (2003) identified the immaturity of the adolescent central nervous system, the lack of recognition that a concussion has occurred, and the subjective nature associated with self-reporting of symptoms as the reasons for increased susceptibility in high school students. McKeever and Schatz (2003) reported that the younger brain is more vulnerable to brain trauma because of a greater head to body ratio, thinner cranial bones, and decreased myelination. In addition, it is believed that the difference in fitness levels and in equipment could increase the rate of concussions in student age athletes. Due to increased susceptibility, high school athletes are three times more likely to experience a second concussion during a season (Iverson, 2005). Failure to manage concussions properly may lead to long-term consequences, such as difficulty learning, emotional difficulty and personality changes (Iverson, Lovell & Smith, 2000).

State Legislation and the National Collegiate Athletic Association

Because of the high incidence of concussion in school-age athletes, legislators have introduced bills to provide guidelines for the management of sports concussions. As previously stated, there is no consensus regarding return to play. As of January 2014, all 50 states and the District of Columbia have adopted youth concussion laws. (“USA Football Heads up”, 2014).

Many of the states that adopted concussion laws followed the lead of the National Collegiate Athletic Association (NCAA), which adopted their policy in April 2010. The NCAA policy indicates that any athlete who suffers a concussion should be removed from play and should not return to play until a team physician or a designated person clears him or her (NCAA, 2010). In addition, student athletes should be educated regarding concussion and concussion management and must sign a statement accepting responsibility for reporting injuries, including concussions, to medical staff. Generally, the wording of each state's legislation is different. However, most of the bills have recurring themes: (a) coaches, and trainers, must receive training in concussion management (b) concussion management for coaches and trainers must be revised annually, with periodic recertification (c) athlete and parents must be educated regarding concussion symptoms prior to the start of the season and must sign informed consent allowing the student to play, (d) athletes who have sustained a concussion during a game may not return to play in the same game (e) before returning to play, an athlete must receive written clearance from a physician or another licensed health professional, and (f) the athlete must follow a graduated return to normal activities (i.e., return to school and return to play) (NCAA, 2010).

Federal legislation

In January 2010, Senator Bishop of New York introduced the "Protecting Student Athletes from Concussion Act of 2010" to the U.S. Congress. The bill would require that all school districts that receive elementary and secondary education act funding must establish regulations for the prevention and treatment of concussions (Duff, 2009). The federal legislation is consistent with other state laws and with the NCAA regulations. The

legislation proposed education for school administrators, athletes, and parents regarding sports concussions, support for students recovering from concussions, which includes academic accommodations, and best practices to ensure safety standards. This legislation was never reported out of Committee, and did not receive congressional support.

New Jersey State Legislation

Governor Christie signed the New Jersey Concussion Law in December 2010. The law mandates that New Jersey school districts develop a written model policy that outlines protocols to ensure the safety of student athletes. The law requires that by the start of the 2011-2012 scholastic year: (a) all coaches, school nurses, and team physicians complete a head injury safety training program (b) all schools provide an educational sheet to all students athletes and obtain written consent from the student athletes and their parents (c) any student athlete who is suspected of having sustained a concussion be removed from play and, (4) the athlete may not return to competition until he or she receives a clearance from an individual who is trained in concussion treatment and is in compliance with the athlete's school district (New Jersey Concussion Law, 2010).

Definition of concussion

The historical definition of a concussion refers to its Latin origin "concutere" meaning agitation or shaking (Marron, Lovell, Norwig, Podell, Powell et al., 2000). The American Medical Association and the Committee of Head Injury Nomenclature of the Congress of Neurological Surgeons define a concussion as "a clinical syndrome characterized by the immediate and posttraumatic impairment of neurological function i.e., alteration of consciousness, disturbance of vision and equilibrium" (author, 1966,

p.21). The American Academy of Neurology described cerebral concussion as an “altered mental state that may or may not include loss of consciousness” (p.42).

The most prominent symptoms of concussions are amnesia and confusion. The Concussion in Sports Group (CSG), comprised of the Federation Internationale de Football, the International Hockey Federation, as well as the International Olympic Committee (IOC) defines a concussion as a “complex pathophysiological process affecting the brain induced by traumatic biomechanical forces” (p . 1). The Brain Injury Interdisciplinary Special Interest Group of the American Congress of Rehabilitation Medicine defines Mild Traumatic Brain injury as “ a traumatically induced physiological disruption of brain function as manifested by at least one of the following “(1) loss of consciousness, (2) loss of memory for events, (3) alteration in mental state such as being dazed, confused or disoriented, (4) neurological deficits that may not be transient but where the severity of the injury does not exceed loss of consciousness of approximately 30 minutes, an initial Glasgow coma scale of 13-15 and posttraumatic amnesia greater than 24 hours” (ACRM, p.1). Several common features that incorporate clinical, pathological, and biomechanical injury constructs may be used in defining the nature of concussive brain injury.

Concussions may be caused either by a direct blow to the head, face, neck, or elsewhere on the body, with an impulsive force transmitted to the head. Concussions typically result in the rapid onset of short-lived impairments of neurological functions that resolve spontaneously (Aubrey, Cantu, Dvorak, Graf-Baumann, Johnston, 2002). Concussions may result in neuropathological changes, but the acute clinical symptoms largely reflect a functional disturbance rather than structural injury. Concussions result in

a graded set of clinical syndromes that may or may not involve loss of consciousness. Resolution of the clinical and cognitive symptoms typically follows a sequential course. Concussions are typically associated with grossly normal neuroimaging studies.

Biomechanical Forces

Sports concussions are the result of two types of biomechanical forces on the head: acceleration-deceleration forces and/or rotational forces (Bailes, 2001). Acceleration-deceleration can occur when an object travels at a high velocity and then strikes the head. Acceleration-deceleration forces also occur when the body or the head are in motion and collide with a stationary object (Solomon, Johnston, & Lovell, 2006). In rotational impacts, an external force rotates the head from side to side. The researchers noted the following sequence associated with rotational impact: the brain rotates on an axis, causing the stretching/tearing of axons; the stretching/tearing of blood vessels results in hematoma, and finally, the brain strikes the skull, causing a contusion. Rotational forces are common in football when a quarterback is sacked and his head rotates from the impact of the tackle (Bailes & Cantu, 2001). Burke (2001) studied the mechanism of concussive injury in National Hockey League (NHL) players. He concluded that contact with the boards, glass, and ice accounted for 42% of concussions. An elbow or a forearm to the head caused 21% of concussions; a shoulder to the head contact led to 19% of concussions; fights caused 12% of concussions; and a puck or a stick to the head led to 6 % of concussions.

Neurometabolic cascade

Concussions are followed by a complex cascade of ionic, metabolic, and physiological events (Giza & Hovda, 2001). In the earliest stage of a concussion, the brain releases random neurotransmitters that cause a "substantial efflux of potassium, triggering a brief period of hyperglycolysis that is followed by a persistent calcium influx, mitochondrial dysfunction with decreased oxidative metabolism; diminished cerebral glucose metabolism reduced cerebral blood flow and axonal injury" (Giza et.al. p. 229). The later stages of the neurometabolic cascade include delayed cell death or return to homeostasis in terms of recovered glucose levels and cerebral blood flow, as well as alterations in axonal disconnection.

Immediately after biomechanical injury to the brain, the brain starts to "indiscriminately release … neurotransmitters and unchecked ionic fluxes occur" (Giza et al., p . 228). Giza et al. studied metabolic changes and changes in brain chemistry during and after a concussion when these occur in college football and rugby players. They concluded that the brain releases 50% above normal levels of glutamate right after sustaining a concussion. In addition, potassium exits brain cells at up to 400% higher than normal rates, and calcium enters brain cells up to 500% above the normal. The release of neurotransmitters disrupts the working of the sodium potassium. To repair the neuronal membrane to baseline, the sodium potassium pump works overtime. "Hypermetabolism occurs in a setting of diminished cerebral blood flow, and the disparity between glucose supply and demand triggers a cellular energy crisis; following the period of accelerated glucose utilization the brain goes into a period of depressed metabolism. Calcium accumulation in the brain can activate pathways leading to cell death" (Giza et al., p.

228). They also found that blood flow decreased up to 50% within 2 minutes of the concussion's occurrence. The researchers concluded the decrease happens as a result of the disruption of normal calcium levels.

Vink and McIntosh (1990) found that, following a concussion, intracellular magnesium levels were reduced immediately and remained low for up to 4 days. Lower levels of magnesium are correlated with post injury neurological deficits; the restoration of magnesium levels to baseline is correlated with improved motor performance in animals. In a subsequent study, Giza and Hovda (2001) investigated the return of neurometabolic cascade (i.e., calcium, sodium, potassium, etc.) to baseline levels. Their research revealed that glutamate levels returned to baseline within 3.5 minutes post injury. Potassium levels may not return to normal for about 20 minutes, and calcium levels may not return to baseline levels for more than 3 days. The most important finding from the study was that the blood flow levels were not restored to normal until a week or so after the concussion (Giza & Hovda, 2001).

In addition to the changes in the sodium potassium pump, researchers have found that concussions "alter the glutamatergic (NMDA), adrenergic and cholinergic system" (Osteen, Giza, & Hovda, 2000, p. 210). Concussions lead to quick changes in the "choline acetyltransferase activity and loss of forebrain cholinergic neurons" (Osteen, et al., 2000, p. 210). Impaired cholinergic neurotransmission has been implicated in slow processing speed and learning deficits (Hepler, Olton, Wenk, & Coyle, 1985). In addition, "long-term potentiation, an NMDA-dependent measure of plasticity, may be persistently impaired in the hippocampus after concussive brain injury" (Sick, Perez-Pinzon, & Feng, 1998, p. 288). Concussions also appear to alter the inhibitory

neurotransmitters. The loss of inhibitory neurons could dispose the brain to successive development of seizures (Lee, Smith, Hovda, & Becker, 1995).

Diffuse axonal injury

Researchers have also concluded that concussive brain injuries occur as a result of stretching and deformation within the brain, which results in the stretching of nerve fibers and axonal damage (Gennarelli, 1986). The strain in the brain is dependent upon the magnitude of the hit, the biomechanical forces, and the brain anatomy. The researcher concluded that axons are the structures most vulnerable to the type of strain that is correlated with concussive injuries Strains happen as a result of the fact that "the membrane potential of the axon becomes progressively more depolarized as strain is increased until it is incapable of transmitting electrical impulses" (Gennarelli, 1986, p. 26). In the seminal study, he identified ten steps that detail the sequence of concussion as a result of strain and axonal damages:

(1) An athlete receives an indirect blow to the face and/or direct blow to the skull.

(2) The blow to the skull or face results in brain acceleration.

(3) Brain acceleration acts as stressor, which produces twists or strains within the brain.

(4) The magnitude of the strain varies within the brain. However, researchers have found that strains are usually "distributed centripetally, with maximal strains at or near the brain surface and progressively smaller strains further inward" (Gennarelli, 1986, p. 27).

(5) At the cellular level, large strains physically disrupt axons, resulting in permanent elimination of axonal function and disturbances of the neuronal network.

6) Smaller strains alter the “axonal membrane excitability, which results in transient depolarization and inability to propagate action potential” (Gennarelli, 1986, p. 27).
7) Strain first affects cerebral cortical functions and the lower brainstem. As more strain occurs, the upper brain stem axons become dysfunctional, which results in neuronal dysfunction that occurs at all levels.
8) Lower brain stem dysfunction results in coma-like symptoms (in the past, a coma was considered the hallmark symptom of concussion). Cortical dysfunction also begins before those of upper brain structure. A concussion frequently affects brain pathways associated with memory.
9) The damaged brain structures go through transitional states between axotomy and briefly reversible membrane damage. The reversibility of the damage to axons may contribute to the resolution of certain functions and cortical structures over time.

Brain anatomy

It is essential to note that symptom presentation of the athlete with a concussion depends on the biomechanical forces of the injury, the pathophysiology of the brain, and the affected brain structure (Collins & Hawn, 2002). The researchers concluded that a blow to the right or left temporal lobe is likely to result in confusion and memory loss, such as amnesia. A blow to the occipital lobe could result in sensitivity to noise/light, visual disturbance, dizziness, and slowed processing speed. A blow to the front of the head (frontal lobe) could cause personality change, difficulty in executing sports assignments (such as remembering the intended play), confusion, and mood disturbances.

A blow to the back of the head could result in loss of consciousness due to the closeness to more primitive brain areas such as the brainstem, which is responsible for consciousness (Collins & Hawn, 2002).

Neuropsychological testing

Barth, Alves, Ryan, Macciocchi, Rime et al. (1989) obtained neuropsychological test data from injured football players as well as from two control populations (non injured student population and injury other than to the head). The neuropsychological tests used in this study were the Trail Making Test, Symbol Digit Modalities Test (SDMT), and the Paced Auditory Serial Addition Test (PASAT). The researchers were able to conclude that mild traumatic brain injury resulted in cognitive and information processing deficits, which are detectable within 24 hours following an injury. The researchers suggested that complete recovery proceeds over five to ten days following an injury, specifically on performance of the PASAT and the SDMT. During the 1990s, Lovell and Collins (1998) initiated several neuropsychological studies among professional football players. Preseason baseline testing was done with the Pittsburgh Steelers football organization. The neuropsychological tests that the researchers administered were the Hopkins Verbal Learning Test, the Trail Making Test, the Controlled Oral Word Association Test, Digit Span, and the Grooved Peg Board. These tests were designed to evaluate the athletes' verbal memory, learning, executive functioning, attention processing, information processing, psychomotor functioning, visual scanning, and complex attention. The researchers concluded that these cognitive domains seem to be affected when an athlete sustains a concussion. These tests detect

differences in cognitive functioning and are useful in evaluating the progress the athlete is making (Lovell & Collins, 1998).

Assessment on the field of play

In order to create a standardized evaluation of a concussion on the field of play, McCrea, Kelly, Kluge, Ackley and Randolph (1997) created the Standardized Assessment of Concussion (SAC). The SAC contains five orientation questions (date, month, time, day, year), a five-word list-learning task (three learning trials), and digits backwards, months of the year in reverse, learning, and delayed recall. A brief neurological screening and physical maneuvers are also recommended. The instrument was developed using a sample of 141 non-concussed high-school football players. In addition, six athletes who sustained concussion were evaluated in this study. In a later study, McCrea (1997) provided SAC data on 568 non-concussed colleges and high school students and a sample of 33 concussed athletes. All players were assessed prior to the beginning of the season. Injured athletes were tested with the SAC immediately after injury and at 48 hours post-injury. The author found significant differences between the concussed and the non-concussed players when the players' scores were compared with their baseline performances (McCrea, 1997). Lovell et al. (1999) devised a rink-side clinical evaluation for the NHL. The rink-side approach measures orientation, memory, physical signs, and neurobehavioral symptoms. Questions regarding orientation and memory are specific to hockey: description of the play prior to the hit, score of the game, colors on the opposing team, etc. Balance is assessed using a tandem stance with skates on. Because of the many languages spoken by NHL players and the varying levels of education, frequently used hockey-related words are used to assess memory (i.e., coach,

stick, puck), and sequence learning may be assessed by sequentially pointing to the head, knee, hip, foot, nose, etc.

Computer testing

Computerized neuropsychological testing allows for efficient collection of baseline data and subsequent comparison of post-concussion data (Theye & Mueller, 2004). Schatz and Browndyke (2002) indicated that computerized neuropsychological testing provides the most promising way to assess concussion objectively. The most widely used, scientifically validated test is the Immediate Post-Concussion Assessment and Cognitive Testing (ImPACT) (Lovell et al., 2003). The system also allows researchers to track recovery and to help with the determination of return to play. ImPACT, which takes approximately 20 minutes to complete, measures multiple aspects of cognitive functioning in athletes, including: attention span, working memory, reaction time, response variability, sustained and selective attention time and, nonverbal problem solving. In addition, a major advantage of ImPACT is that there are many alternate versions of the test. Therefore, it allows researchers and clinicians to evaluate the client multiple times, thereby avoiding confounding variables such as practice effects.

The CogSport is a computerized neuropsychological test designed to detect mild cognitive changes in athletes (“CogSport”, 2011). “The CogSport helps guide a physician in determining medical decisions about returning to play and school and monitoring the athlete’s progress” (“CogSport”, 2011). The main advantage of CogSport is the relatively easy and short administration of the test. CogSport is optimized for sensitivity to concussion and measures motor function, reaction time, memory, and attention. The CogSport also includes a health history questionnaire and symptom inventory. Prior to

the start of the season, athletes take a baseline test and then take the test again after sustaining a concussion. The results are then compared and provide an objective analysis of data ("CogSport", 2011).

The HeadMinder solution is another computerized test used by physicians to detect concussions ("HeadMinder", 2011). The Headminder test consists of a series of computerized tests that require simple responses to standard keywords. The tests measures domains typically associated with "brain dysfunctions such as attention, concentration, reaction time, short- and long-term memory, and processing speed" ("HeadMinder", 2011).

Randolph (2001) reported that a computerized battery may be the best approach to evaluate sports related concussion for several reasons such as time and cost constraints, as well as the availability of qualified personnel, an objective approach to administration and the scoring of test protocols. Because some players may be traded to another team, computerized testing allows for the transfer of data from one database to another.

Recovery curve

McCrea, Hammeke, Olsen, Leo, and Guskiewicz, (2004) studied collegiate athletes for three years and found that recovery function is dependent upon the cognitive function that is measured. The researchers concluded that balance deficits dissipate within three to five days, cognitive functioning returned to baseline within five to seven days, and somatic symptoms such as headaches resolved by day seven. Researchers have also reported that the symptoms of concussions resolve more slowly in the high school student than in the collegiate athlete (Field, Collins, Lovell, & Maroon, 2003). Particularly, the researchers found that high school students exhibited significant memory

problems, but that collegiate athletes exhibited similar deficits only within the 24 hours post- injury. The researchers demonstrated that even after 7 days following a concussion, high school athletes performed worse than "age matched control on measures of neurocognitive functioning" (Field et al., 2003 p.548). The researchers conducted a similar study at the collegiate level and found that even when collegiate athletes had more severe concussions, the athletes performed similarly to age-matched controls at 3 days following a concussion.

Post Concussion Syndrome (PCS)

It is imperative that neuropsychologists, athletic trainers, and physicians be cognizant of the player's desire to return to the game prior to the resolution of his or her symptoms. It is believed that roughly 85% of concussions are undiagnosed (Cantu, 2001). In fact, it is believed that the actual number of concussions is seven times the 300,000 concussions diagnosed in athletes each year. Post-concussion syndrome (PCS) is defined as any potentially permanent symptom or symptoms from a single episode or chronic history of brain injury that lingers beyond a few weeks after injury (Collins & Hawn, 2002). The most common symptoms that persist following concussions are memory impairment, fatigue, headaches, and dizziness (Cantu, 2001). In a prospective study conducted in Belfast, post-concussive symptoms tended to disappear within six months in 52% of reported cases. The post-concussive symptoms have persisted in 16% of cases. The researchers indicated that in 32% of the reported cases the individual experienced worsening of symptoms between six weeks and six months. Research has indicated that post-concussive syndrome creates a functional impairment that can be manifested by

unemployment and marital dysfunction (Bryant et al., 2010). Head injuries sequale is most frequent in males aged 14-24 years old (Hessen, Nestvold, & Anderson, 2007).

The Diagnostic and Statistical Manual of Mental Disorders, fourth edition revised (DSM-IV-TR) lists criteria utilized by psychiatrists and psychologists in order to diagnose PCS. The criteria state that the patient must have a history of head injury and there must be evidence from a "neuropsychological testing of quantified cognitive assessment" (APA, 2000, p. 84). The deficits can be in the form of attention (shifting attention, concentration, or performing simultaneous tasks), or memory (recalling information or learning new information). The DSM-IV-TR criteria state that athletes must experience three or more of the following symptoms shortly after the trauma and have them last at least three months: (1) disordered sleep; (2) becoming fatigued easily; (3) headaches; (4) vertigo; (5) dizziness; (6) anxiety, depression, or affective labiality; (7) changes in personality; (8) irritability or aggression; (9) apathy. These symptoms must have their onset after head trauma or must represent a worsening of symptoms. According to the DSM-IV-TR, the symptoms must cause a marked disturbance that causes impairment in "social or occupational functioning" (APA, 2000, P.84). In children and adolescents the impairment may be exhibited by worsening of academic performance. Finally, the DSM-IV-TR states that the post-concussive symptoms are not better accounted for by another mental diagnosis.

The DSM-V highlights the need for early detection and treatment of neurocognitive impairment (MND). The DSM-V describes mild neurocognitive impairment as, "Cognitive decline that requires compensatory strategies and accommodations to help maintain independence and perform activities of daily living"

(APA, 2013). Particularly, the DSM-V focuses on the functional impairment caused in the specified cognitive domain.

Table 1

DSM-V cognitive domains and their functional impairment

Domain	**Functional Impairment**
Attention	Increased length of time completing tasks Errors on routine tasks Unable to multitask
Executive functioning	Increased effort and fatigue overwhelmed by external stimulus Difficulty shifting mindsets
Learning and memory	Difficulty recalling short-term information Increased reliance on compensatory strategies (i.e., use of calendar) Increased repetition
Language	Anomia Grammatical errors Increased word substitutions
Perceptual motor	Decreased preciseness Greater effort when assembling objects Difficulty following directions
Social cognition	Difficulty interpreting social cues Decreased inhibition, empathy

According to the DSM-V, in order to be diagnosed with MND, an athlete must meet the following criteria:

A. "Evidence of cognitive decline in 1 or more cognitive domain
B. Cognitive deficits don't interfere with performing activities of daily living
C. The cognitive deficits do not occur exclusively in the context of delirium
D. The cognitive deficits are not better explained by another mental disorder."

(APA, 2013, p. 301)

Symptoms of PCS

Pardini, Stump, Lovell, Collins, Moritz, and Fu (2004) stated that PCS symptomology could be divided into four distinct clusters: sleep, cognitive, somatic and emotional. The authors of the article assume interplay between the symptoms subsequent to a concussion. Therefore, Reddy (2011) advocates the use of a thorough medical examination that includes an investigation of all four domains.

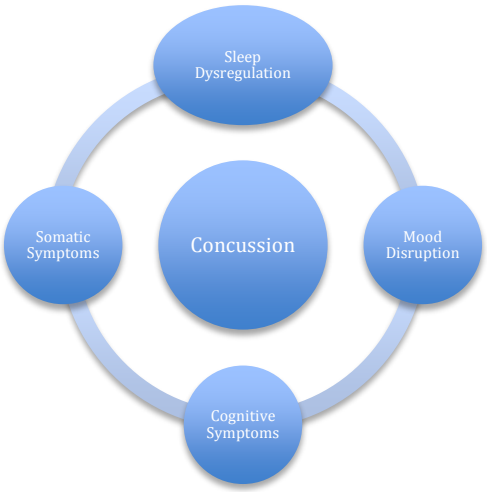

Figure 1- symptom cluster of PCS- Reddy, 2011

Somatic symptoms

The most common symptom following a concussion is headaches which is present in 85% of individuals who have sustained a concussion (Oberman, Keidal, & Diener, 2010). The treatments of headaches are essential because that symptom frequently leads to other somatic symptoms such as dizziness, sensitivity to light and noise (Reddy, 2011). Currently, the main treatments for headaches are pharmacological, and include the use of beta-blockers and calcium channels blockers. Additionally, augmentative therapies such as: massage therapy, acupuncture, yoga and biofeedback could also be beneficial in alleviating somatic symptoms (Sun-Edelstein & Mauskop, 2011). Another hallmark of somatic symptom is postural instability and loss of balance. Up to 80% of athletes have reported dizziness, subsequent to a concussion. Research has shown that vestibular therapy has been beneficial in improving stability in clients (Chamelian & Feinstein, 2004).

Sleep related

In this cluster, the symptoms revolve around the quantity and quality of sleep. Particularly, clinicians should be evaluating whether a student athlete is sleeping too much or too little; they should also be examining the quality of sleeping, such as whether the athlete sleeps throughout the night or whether sleep is fragmented (Perllis, Artiola, & Giles, 1997). It is important to examine the sleep pattern because poor sleep quality frequently is associated with difficulty attending to stimuli, depression, and a decreased quality of life (Walsh, 2004). In order to treat athletes suffering from sleep disturbance, it is recommend that they adapt a behavioral approach that consists of establishing a

consistent bed time, minimizing distractions, and decreasing the use of stimulant behaviors (Morin, Jarvis, & Lynch, 2007).

Cognitive symptoms

In this domain, the symptoms revolve around issues associated with memory, concentration, and cognitive deficits. This domain is particularly relevant to student athletes because the ramifications of a concussion can have a lasting impact on their academic and vocational achievements. Student athletes often report declining academic achievement (Reddy, 2011). Student athletes most frequently report decreased reaction time and short-term memory. In terms of treating this cluster of symptoms, it has been shown that stimulant medications have become the industry standard (Warden et al., 2006). Additionally, if post-concussive symptoms persist, student athletes could benefit from being taught proactive strategies.

Emotional symptoms

In this cluster, the predominant symptoms include depression, anxiety, and irritability. These manifestations often are correlated and manifested because of other symptoms clusters (Reddy, 2011). Anxiety and depression could be caused by frustration tolerance associated with the cognitive domain. Furthermore, some student athletes may feel isolated from their peers, which could be a precipitant for a depressive disorder. In terms of treatment, if a student athlete exhibits anxious or depressive symptomology, a psychologist or psychiatrist should evaluate him or her. Selective Serotonin Reuptake Inhibitor (SSRI) or antidepressants could be used to alleviate some of the symptoms; however, due to the increased risk of suicide among adolescents, the prescription of those medications should be carefully reviewed (Hammad, Laughren, & Racoosin, 2006).

Second Impact Syndrome

The brain is more vulnerable to Second Impact Syndrome (SIS) due to metabolic dysfunction (Kontos et al., 2004). SIS occurs very rapidly, causing "dysautoregulation of the brain that involves increased intracranial pressure, brainstem failure, coma and frequently death (50%)" (Collins & Hawn, 2002, p. 15). The immediate cause of death is typically the result of brain swelling, causing increased intracranial pressure. There appears to be growing evidence of a critical period for optimal recovery from a concussive event. However, it is important to note that SIS is rare and little researched (Erlanger et al., 1999).

Dementia pugilistica

The concept of Dementia pugilistica was first proposed by Martland in 1928; he coined the term "punch-drunk" to refer to a presentation of symptoms that appeared to be the result of repeated blows to the head. This syndrome was long recognized among professional boxers and was termed "dementia puglistica" by Millspaugh (1937) and "psychopathic deterioration of pugilists" by Courville (1962). In a sentinel study, Corsellis, Bruton, and Freeman-Browne (1973) described three stages of clinical deterioration as a result of Dementia pugilistica. The first stage is characterized by affective disturbances and psychotic symptoms. Social instability, erratic behavior, memory loss, and initial symptoms appear during the second stage. The third stage consists of general cognitive dysfunction, progressing to dementia and often accompanied by Parkinsonism, as well as speech and gait abnormalities. They also summarized the most common gross neurophysiological findings as: thinning of the corpus collosum, reduction in brain weight, enlargement of the lateral and third ventricle,

and neuronal loss of the cerebral tonsils. The reduction in brain weight is associated with atrophy of the frontal lobe (36%), temporal lobe (31%), parietal lobe (22%), and, less frequently, the occipital lobe (3%). As dementia pugilistica progresses, atrophy of the hippocampus, amygdala, thalamus, cerebellum, and brain stem may also occur (Corsellis, Bruton, and Freeman-Browne, 1973).

Dementia pugilistica can be explained by: (a) cerebellar and other scarring of the brain associated with dysarthria and ataxia, (b) substantia nigra degeneration associated with Parkinsonian symptoms, or (c) abnormalities of the septum pellucidum associated with behavioral disturbances (Corsellis et al., 1973). Neuropathological characteristics include cerebral atrophy, loss of cells in the cerebellum, and prominent neurofibrillary tangles in both the cortical and subcortical areas, particularly in the limbic structures and the substantia nigra (McKee et al., 2009).

Chronic traumatic encephalopathy (CTE)

According to Sports Legacy Institute (2012), CTE first appeared in the medical literature in 1966. There were only 49 documented cases dating from 1929-2009. In the past, it was believed that CTE was a boxer's disorder because 39 of the 49 documented cases were boxers. The sports legacy was co-founded by Dr. Robert Cantu, an expert in the field of concussions, and Chris Nowinski, a former wrestler who had to retire from professional wrestling due to multiple concussions ("Sportslegacy", 2011). In 2008, Robert Cantu and Christopher Nowinski partnered with Dr. McKee and Dr. Stern to create the Center for the Study of Traumatic Encephalopathy at Boston University School of Medicine (BUCSTE). BUCSTE is the first center in the world dedicated to studying CTE (Sportslegacy.org). Through the efforts of the BUCSTE, researchers have been able

to identify CTE in 17 of 18 deceased athletes, ranging in age from 18-83. In recent years Dr. McKee has found CTE in 26 brains: those of hockey players, pro wrestlers, boxers, and college and semi-pro players. She also has examined the brains of combat soldiers. As knowledge increases, it appears that CTE is becoming a public health problem. The BUCSTE has recently submitted a grant to the National Institute of Health in order to continue to work on diagnosing CTE in living patients ("sportslegacy", 2012).

In the earliest stage, CTE is considered to be a constellation of symptoms caused by lesions affecting the cerebellar, pyramidal, and extrapyramidal systems (Omalu et al., 2010). As the disorder progresses, cognitive impairment becomes the major neurological feature. Clinical signs, cognitive signs, and behavioral signs characterize the disorder. In the mildest form of CTE cases, the most common presenting symptoms are slurring and dysarthria. In fact, 90% of all subjects have reported dysarthria, which is often accompanied by gait ataxia. Many subjects also report disabling and persistent headaches. Half also report a fine and intermittent tremor (Omalu et al., 2010).

Neuropsychological tests are used primarily in assessing the cognitive signs, because the tests are the most sensitive measures for use in detecting neurological injury. In addition, neuropsychological tests potentially allow for the earliest detection of cognitive change or cognitive decline (Erlanger et al., 1999). In the pre symptomatic state, cognitive deficits affecting attention mechanism occur as an early feature. As the disorder progresses, neuropsychological deficits are noted in the disturbance of memory, decreased processing speed and decreased concentration (Omalu et al. 2010). Neuropsychological studies of former and active boxers who have CTE have found difficulties in memory, information processing and speed, finger-tapping, attention and

concentration, sequencing ability, and frontal executive functions such as judgment, abstraction, reasoning, planning, and organization.

Neurobehavioral changes also may occur during the development of CTE. In the mildest stage, the change is typically characterized by emotional lability, hypomania, and euphoria (McCrory, Zazryn, & Cameron, 2007). Later neurobehavioral features include psychomotor retardation, aggression, suspiciousness, and restlessness. In the progression of the disorder, clients exhibit difficulty with impulse control, disinhibition, irritability, inappropriateness, and explosive outbursts of aggression (Erlanger et al., 1999).

It is important to note that, as with all neurodegenerative diseases, definitive diagnosis of CTE can be made only by direct post mortem brain tissue analysis (Omalu, Bailes, Hammers, & Fitzsimmons, 2010). Mendez (1995) found that, following CTE, there was reduced cholinergic activity in the basal forebrain, as well as beta amyloid plaques distributed diffusely. Jordan et al. (1997) identified apolipoprotein Ee4 as a potential genetic risk factor for developing CTE during the course of a career in sports, particularly in boxing. It is also believed that the pathology of CTE involves atrophy of the limbic system, which regulates emotions and therefore could lead to uncharacteristic behaviors, such as increased aggression, and suicidal and homicidal ideations. Following post mortem autopsies of individuals with CTE, neurofibrillary tangles, neurotic threads, and dead neurons were found throughout the basal ganglia, neocortex, substantia nigra, and brain stem (Cajigal, 2007).

Case series subjects

In 2010, Omalu et al. identified and examined a case series, comprising four deceased National Football League players and one deceased World Wrestling Entertainment wrestler. All of the subjects committed suicide and had similar premorbid neuropsychiatric chemistry, which resulted from repeated head trauma. The presence of diffuse cerebral tauopathy, which is consistent with CTE, was confirmed via autopsy of brain tissue. All five cases exhibited major depression, neuropsychiatric symptoms, cognitive impairment, suicide, and parasuicide.

The key risk factors for suicide are depression and other mental disorders; more than 90% of people who die by suicide have these risk factors. The researchers concluded that CTE was a common risk factor in all five cases in their study and could be a risk factor for individuals with repeated concussions (Omalu et al., 2010). The researchers hypothesized that the mechanism of depression in these subjects was neurotransmitter imbalances, due to the impairment of normal neuronal functioning and destruction of neurons by "hyperphosphorylated tau in the form of neurofibrillary tangles and neuronic threads in specific brain nuclei and system" (p. 132).

Return to play

Because of the variability in the assessment of concussions and of the recovery phase, many researchers have struggled with the concept of return to play. Canute (1988), and Theye and Mueller (2004) reported that return-to-play decisions seemed to be dictated by the experience of the athletes' physicians. It was noted that most return to play decisions are based on subjectivity rather than objectivity. As outlined previously, returning to play before all symptoms have resolved greatly increases the risk of more

post-concussive complications. The athlete also puts himself/herself at greater risk for SIS. Currently, most researchers and practitioners tend to follow the stepwise return to play which is founded on the orthopedic model (Kissick & Johnston, 2005).

Orthopedic return to play model

The orthopedic return to play model consists of three steps with significant overlap. The initial phase indicates that all athletes must rest and not engage in any aggravating sports activities. As the athlete progresses in recovery, he or she is allowed to engage in athletic activities that could include flexibility, and proprioception. The athlete continues to progress until he or she reaches the third stage, which focuses on return to sports. This last stage would include a gradual increase in sport-specific activity, which in turn leads to full sports participation (Kissick & Johnston, 2005). The major limitation of the orthopedic approach is the fact that the different phases overlap. Because of the overlap, many researchers have difficulty distinguishing between the different phases.

Stepwise return to play protocol

Many practitioners use the stepwise return to play protocol (Canadian Academy of Sports Medicine Concussion Committee, 2000). It is important to note that the player must be asymptomatic from cognitive, somatic and emotional sequelae of concussions (Kissick & Johnston, 2005). In this model there is no overlap; in order to progress to the next step, there must be a minimum of a one-day wait period with no return of symptoms. Researchers have observed that many symptoms do not worsen during the time of exertion, but rather later in the day or in the following day (Kissick & Johnston, 2005).

The Step-Wise Return to Play Protocol includes six steps (McCrory et al.,2009). Step one is no activity and complete rest. It has been noted that rest is an extremely important step and the athlete should be removed from any exertion or cognitive activity. For high-school students, cognitive ability constitutes schoolwork and homework. Step two consists of light aerobic activity, such as walking; no resistance training is allowed. Step three includes sports-specific activities, for example, skating in ice hockey. Step four includes noncontact training drills; this may possibly include resistance training such as weight lifting. Steps five and six involve returning to play; the athlete is involved in full physical contact and is allowed to participate in all sports related activities. (McCrory et al.,2009).

In addition, prior to the return of players to full contact, it is important to educate the athlete regarding reduction of future concussions and technique, adherence to rules, equipment usage, and the importance of reporting symptoms (Kissick & Johnston, 2005). The decision to return an athlete to play should be multifactorial, including factors such as a history of previous concussions, time since the last concussion, neurocognitive testing as it pertains to return to baseline, and whether or not the player is asymptomatic.

Return to school

Similar to the stepwise gradual return to play, a concussed player must gradually reintegrate into school activities. As previously stated, some student athletes may experience persistent and chronic neurobehavioral and cognitive deficits (Duff, 2009). The researcher noted that it is imperative that the student athlete gradually transition back to a full academic schedule in order to ensure academic success and social functioning. Additionally, the author noted that immediately following a concussion and for a few

days of recovery from symptoms, the student athlete should rest from athletic competition and from the cognitive demands of schoolwork. McGrath (2010) notes that the "goal is to support the recovering students in keeping up with academic demands in a way that does not overstress the cognitive functions and result in worsening symptoms" (p. 494). In a sense, it is the responsibility of medical professionals and school personnel to balance rest and academic success.

Kirkwood, Yeates, and Wilson (2006) identified strategies useful in supporting the student athlete when he or she returns to school following a concussion. The researchers have divided the strategies into three categories: initial transition back to school, school-based support and classroom-based support. During the initial transition back to school, school personnel are alerted to the injury, and the athlete is reintegrated to scholastic work gradually, sometimes involving part-time schedules. Additionally, extra assistance is provided to the athlete during this phase in order to complete schoolwork. During the school-based phase, the athlete is provided frequent breaks and designated rest time. It is essential that cognitive demands in school be reduced; for example, an athlete should not be allowed to take more than one test daily. It is also recommended that during this phase, the student athlete have reduced homework assignments and class load.

From an institutional perspective, school personnel should monitor the student athlete for up to 2 to 3 months (Kirkwood et al., 2006). The strategies in the classroom-based support phase include alternate forms for tests, allowing flexibility of assignment due dates, and waiving time constraints for tests. During this stage, the student athlete

may be allowed preferential seating for close monitoring and decreasing distractions (Kirkwood et al., 2006).

Reasonable accommodations for concussed student athletes

McGrath (2010) outlines several accommodations/modifications that may help the student athlete transition to school slowly and successfully.

1. Excused absences from class: For the student athlete still experiencing acute concussion systems, it is imperative that s/he rests completely. During the first few days after a concussion, it is important that the student athlete be free of any cognitive demands. Following the resolution of some symptoms, the athlete may return to school on a partial basis. This may involve allowing the student initially to attend only core classes, arrive at school later, and leave earlier in the day.
2. Extension of assignments: Allow extra time for the completion of homework assignments.
3. Extended testing time: Due to difficulty processing information, extended time is frequently needed to complete tests.
4. Excusal from team sports/gym class: It is essential that the student athlete avoid any physical activity until the resolution of his/her symptoms; therefore, it is recommended that the athlete not engage in any strenuous activity, such as running and weight lifting.
5. Accommodation for oversensitivity to external influences: Many student athletes have difficulty tolerating light and noise after a concussion; therefore, it is recommended that lights be turned off, if possible. If that is not possible, preferential seating in the classroom is recommended.

6. Rest period during the school day: If an athlete is suffering symptoms associated with concussion, it is recommended that s/he be allowed to take a break from the stimulating environment and overwhelming cognitive demands.
7. Postponement or staggering of tests: Due to the mental and cognitive demands associated with test taking, it is recommended that a student athlete recovering from concussion take only one test per day. However, if the student athlete is still symptomatic, it may be recommended that s/he be excused from tests until s/he is able to study for them.
8. Use of a note taker: Due to potential difficulty in multitasking, a note taker may lessen the cognitive load on the athlete.
9. Preferential classroom seating: The student athlete who experiences attention deficits may benefit from preferential seating, such as seating in the front row and away from doors and windows.
10. Use of a reader: Reading may exacerbate cognitive symptoms by visual scanning and reading; therefore, a reader may lessen the cognitive load.

Return to schoolwork framework

Recommendations from Nationwide Children's Hospital (2003) indicated that return to school following a concussion is completed in five stages:

Stage 1, No school: During this phase, the athlete may experience a high number of symptoms that may make it difficult to benefit from school. Physical symptoms tend to be most prominent during this phase. It is recommended that the student athlete rest his/her body and brain as much as possible and avoid school and other activities, such as

watching television and playing videogames or computer games that may exacerbate symptoms.

Stage 2, Partial school attendance: During this stage, the student's symptoms are more manageable. The symptoms may worsen if the student athlete engages in complex mental activities for a long duration. During this stage, the athlete will start attending school on a partial basis, focusing on core classes; however, he or she should eliminate busy work and avoid physical activity.

Stage 3, Full day attendance with accommodation: During this stage, the student's symptoms decrease in frequency and in severity. As the student improves, the athlete may gradually increase his/her workload and difficulty of work. In addition, the student athlete should gradually reintroduce symptom triggers. During this stage, the student should continue to prioritize assignments, tests, and projects, gradually increase the amount of homework, and should also be encouraged to ask for accommodations.

Stage 4, Full day attendance without accommodation: The athlete may be asymptomatic or may have milder symptoms. During this stage, the athlete is focused on completing missed scholastic work.

Stage 5, full school and extracurricular involvement: During this stage, the student athlete experiences no symptoms and a medical professional has cleared the athlete to return to play.

Role of school personnel

Many school personnel are responsible for the implementation of school accommodation. The school nurse plays an essential rule because s/he provides daily evaluations and dispenses needed medication. The nursing area may also serve as a rest

and recovery area for the athlete. McGrath (2010) also notes that the school nurse's record of daily contact provides a useful and accurate way of tracking the athlete's symptoms.

The guidance counselor also plays an essential role by coordinating academic accelerations. In some schools, the guidance counselor will be responsible for writing 504 plans that detail accommodations related to a medical condition. A school social worker may also be beneficial to the student athlete by providing guidance and emotional support. As previously stated, some athletes may experience depression as a result of concussion. Finally, through the use of neuropsychological tests, the school psychologist may offer valuable insights into the athlete's difficulties. In addition, the psychologist would be able to recommend modifications and accommodations (McGrath, 2010).

Attitudes regarding concussions

Currently, there are few studies investigating attitudes and knowledge regarding concussion among athletes and among others who are responsible for managing it. A central goal of the proposed investigation is to develop a greater understanding of attitudes and knowledge about concussion among school superintendents and principals. Studies that examined attitudes and knowledge regarding traumatic brain injury (TBI) in the general population, in individuals familiar with TBI, athletes, coaches, and athletic trainers will be reviewed.

General public

Most of the studies conducted on TBI in the general population have focused on moderate and severe TBI. The first study to assess knowledge about TBI in the general population was conducted by Gouvier, Prestholdt, and Warner (1988). The researchers

created a 25-item survey that assessed five domains pertaining to TBI. The survey was administered to 221 participants in southern Louisiana. The domains measured were knowledge of amnesia, knowledge of recovery from TBI, knowledge about the nature and extent of brain damage, and knowledge of the effects of loss of consciousness.

Since the Gouvier (1988) study, three groups of researchers have conducted replication studies. Willer, Johnson, Rempel and Linn (1993), Guilmette and Paglia (2004), and Hux, Schran, and Goeken (2006) have conducted studies in different geographical regions. The sample sizes were 313, 179, and 318, respectively. There was significant overlap in the survey items among the four surveys. The researchers found that the general public's knowledge of TBI may be improving in some areas, but appears to be lacking in other areas. Specifically, it appears that the general population lacks understanding in the areas of causes, signs, and sequelae of TBI (Hux et al., 2006). Most important, the general population appeared to be developing an understanding that TBI can occur without being hit on the head or losing consciousness. Gouvier et al. (1988) and Hux et al. (2006) found that 40% to 60% of the general public mistakenly believed that a second blow to the head could help an individual remember things that they forgot after their first injury. In addition, the general population believed that a person can experience amnesia but have no lasting problems associated with the TBI (Guilmette & Paglia, 2004; Hux et al., 2006).

The researchers identified a particular lack of knowledge in responses to questions pertaining to vulnerability to future TBI. The researchers concluded that approximately 68% to 88% of participants incorrectly indicated that sustaining a TBI does not increase the likelihood of sustaining another TBI. The researchers concluded

that about half of the sample population believed that working hard was essential in recovery time from TBI (Hux et al., 2006).

To summarize, it appears that the general population has a broad understanding and awareness of TBI. However, the general public lacks clear understanding about the resolution and ramifications of TBI.

Individuals familiar with TBI

Again, few studies have explored attitudes and knowledge about TBI in individuals familiar with TBI. The few studies available examined relatives of TBI individuals, educators, and rehabilitation workers. It is assumed that those individuals have more knowledge because of indirect experiences with TBI. Framer and Johnson-Gerard (1997) assessed the knowledge of educators and of rehabilitation workers for people with TBI. The sample consisted of 111 rehabilitation workers, which included physical therapists, psychologists, and physical therapists, and 184 educators, which included school administrators and teachers. The researcher concluded that educators displayed a greater number of misconceptions about TBI than did rehabilitation staff. Interestingly, the researcher found that educators who had been teaching for more than 10 years and had encountered students with TBI were more knowledgeable about concussions than less experienced educators. Specifically, Framer and Johnson-Gerard (1997) found that teachers were not knowledgeable about the potential problems with anger management, the process of emergence from coma, and the increased likelihood of future injuries. Additionally, educators reported misconceptions about the rehabilitation process of a concussed athlete. It appears from this study that teachers have numerous misconceptions, particularly about the rehabilitation process and rate of recovery. In

another 1997 study, Springer, Farmer, and Bouman examined knowledge among 65 family members of people with TBI and 60 people in families who had no experience with TBI. There were substantial between-group differences.

The researchers found that rehabilitation workers were the most knowledge about TBI, especially regarding effects of memory loss, vulnerability to future TBI, and recovery from TBI (Framer & Johnson-Gerard, 1997). Knowledge levels of family members with TBI and of educators were similar (Framer & Johnson-Gerard 1997). The researchers also found that educators were more knowledgeable about cognitive and learning problems (Framer & Johnson-Gerard 1997). Additionally, family members had rates of misconceptions similar to those of the general population regarding recovery and vulnerability. However, it is important to note that family members had superior knowledge in some areas such as recognition of symptoms and treatment options (Gouvier et al., 1997; Springer et al., 1997).

Athletes', coaches', and trainers' attitudes and knowledge

The National Institutes of Health (1999) estimated that approximately 90% of concussions in sports are not reported. A survey of high school athletes revealed that 53% who sustained a concussion did not report it to a coach or medical staff (McCrea, Hammeke, Olsen, Leo, & Guskiewicz, 2004). When asked about the reasons why, the athletes provided three main reasons: 66.4% indicated that they did not think that their symptoms were serious enough; 36.1% indicated that they were unaware they had sustained a concussion, and 41% indicated that they did not wish to be removed from competition (McCrea et al., 2004). It appears that the athletes' attitudes and lack of

knowledge about common signs and symptoms of concussion result in the underreporting of concussion.

Livingston and Ingersoll (2004) examined the knowledge of concussion in 172 college athletes. Among the domains assessed were: definition of concussion, knowledge of long-term concussion sequelae, and attitudes about return-to-play decisions. 60% of subjects indicated that loss of consciousness must be present in order to have sustained a concussion; 12% indicated that they did not know the long-term ramifications of concussion, and17.5% indicated that the decision to return to play should solely be that of the athletes.

Wrightson and Gronwall (1980) also examined attitudes and knowledge about concussion in men who previously sustained a concussion. There were 63 participants, 31 of whom had been concussed. The participants completed a questionnaire on the effect of their own concussion, information about any concussion sustained by family members or friends, and their beliefs about the prevention of future concussions. One third did not express any concern regarding concussions. About 30% of the participants of the study reported that they took measures to decrease the likelihood of future injuries (Wrightson and Gronwall, 1980).

In a similar study, Sefton (2003) created a survey to evaluate knowledge of concussion and identify sources of knowledge about concussion and other domains. The College Football Brain Injury Survey (Sefton, 2003) was developed for athletes and consists of 28 items on return to play (RTP) guidelines, mechanism of injury, definition of concussion, and vulnerability to future concussions. Alternate survey forms were developed for coaches and athletic trainers. The sample consisted of 457 male football

players, 38 coaches, and 8 athletic trainers from eight universities. The study found that about one third of athletes believed that return-to-play could occur immediately following the resolution of concussion. Over 90% of coaches and athletes indicated that a "bell ringer" was different from concussion, suggesting variability in the definition of concussion. Most important, high knowledge levels in athletes correlated with more frequent reporting of concussion, and deficiencies may be contributing to the unsafe attitudes and earlier return to play (Sefton, 2003). A major criticism of the survey was that few items pertained to attitudes and knowledge about concussion management and RTP.

Initially, Simmonds (2005) developed the 52-item Knowledge and Attitudes about Sports Concussion Questionnaire (KASCQ); questions that were deemed invalid were omitted from the original survey, which left 24 items. The survey focuses on four domains: knowledge of concussion, knowledge of RTP, attitudes about concussion, and attitudes regarding RTP. Each of the responses is in true/false format. The sample included 69 males, 45 females, and 3 subjects who did not report their genders. The main criticism of the predecessor KASCQ–24 is that the items relied heavily on attitudes and knowledge regarding return to play and placed less emphasis on items that address attitudes and knowledge about concussion. A major limitation is that most of the sample involved male college athletes. There also appears to be a lack of ethnic diversity that further limits the generalizability of the findings.

In an unpublished dissertation, Simmonds (2005) developed a survey named the Attitudes and Knowledge about Sports Concussion Questionnaire–24 (KASCQ–24). The survey was administered to 117 participants, with a mean age of 21.7 and included 49

football players, 46 undergraduate business students, and 22 undergraduate nursing students. Simmonds (2005) hypothesized that athletes would be more knowledgeable than nursing and business students because of their high levels of exposure to the topic of concussion. Surprisingly, the athletes had a lower score on the KASCQ–24 than the business and nursing students. Lower scores indicated lower levels of safe attitudes and of accurate knowledge regarding concussion (Simmonds, 2005).

Simmonds (2005) indicated that some athletes endorsed attitudes in favor of remaining in competition despite experiencing symptoms of a concussion. Sefton (2003) indicated that approximately one third of his study population reported that it would be acceptable to wait until the end of the game to report a concussion. Additionally, in both the Simonds (2005) and Sefton (2003) studies, athletes believed that they should be the sole decision makers in determining whether or not to return to play. Conversely, athletes who were more knowledgeable about concussion were more likely to report their concussions to people who could help to manage their injuries (Sefton, 2003; Simonds, 2005).

The Rosenbaum Concussion Attitudes and Knowledge Scale (RoCKAS, Rosenbaum, 2007) consist of 40 items. There are three alternate forms that were developed for student athletes, coaches, and athletic trainers. The sample consisted of 95 high school students, 129 coaches, and 142 athletic directors. Each of the forms was organized into five distinct sections: (a) questions regarding knowledge about concussion and sequelae, (b) questions examining knowledge of sports concussion sequelae, (c) questions related to RTP and concussion management, (d) questions examining attitudes about RTP and concussion management that pertain to sports scenarios, and

(e) a checklist that contains postconcussive symptoms and distractor symptoms. Rosenbaum concluded that athletes were not knowledgeable about concussion, particularly regarding future ramifications. Additionally, student athletes demonstrated unsafe attitudes in regard to return to play. Many athletes believed that they should have the final say regarding return to play. Similarly, many athletes did not report that they had experienced concussive symptoms to coaches or athletic trainers.

Postconcussive symptom knowledge

A few studies focused on identifying athletes' knowledge of postconcussive symptoms. The participants in the Sefton study (2003) were given a list of 22 common postconcussive symptoms and eight distractor symptoms (symptoms not associated with concussion) and asked to choose the symptoms characteristic of concussion. About 83% correctly reported headache; 79% correctly reported dizziness, and 59% of the sample correctly identified the other symptoms associated with concussion. Additionally, about 40% to 50% chose distractor symptoms, such as weight loss, diarrhea, and swollen hands (Sefton, 2003).

Kaut, DePompei, Kerr, and Congeni (2003) used a self-report measure to identify 461 male and female college athletes' knowledge of concussion symptoms. Respondents were asked to answer an open-ended question that required them to report having signs and symptoms of brain injury. Within the cognitive domain, memory problems were reported most frequently, accounting for 23.2% of the total responses across all domains. Headaches (11.2%) and nausea (6.3%) were the most frequently reported somatic complaints, and dizziness (10.7%) was the most frequent symptom in the sensory-

perceptual domains. Headache and dizziness are among the most frequently identified symptoms of concussion (Erlanger et al., 1999; Guzkiewicz et al., 2003).

The results of the current study may provide valuable information on attitudes and knowledge about concussion among superintendents and principals in New Jersey. To date, no published studies have examined these variables in superintendents and principals. By obtaining information from these groups, it will be possible to compare their attitudes and knowledge with those of other groups. In addition, the survey developed for the present study seeks to evaluate attitudes and knowledge regarding concussion and the newly enacted concussion law.

Conclusion

As evidenced by the review of relevant literature, high school student athletes are extremely susceptible to concussion. The repercussions of concussion can have a long lasting impact on the student athlete's life, particularly in cognitive, emotional, and school functioning. Recently, research on concussion has gone from focusing solely on treatment to targeting prevention methods. Because of the increased awareness about concussion and the high rates of concussion, state governments have taken action; New Jersey, for example, has implemented a law that requires all school districts with interscholastic sports program to have a concussion policy. The results of this study would allow researchers not only to identify the ease with which the law elements have been implemented, but also to recognize the barriers to implementation. In addition, the results could be useful to advocates in helping school districts in New Jersey and other states to implement concussion management policies.

Research Questions

1. What is the relationship between the knowledge of educators (superintendents and principals) and their attitudes regarding concussion?

2. What is the relationship between the knowledge of educators and their attitudes regarding return to play?

3. What are the deficits in knowledge and what are the strengths of school superintendents and principals regarding concussions?

4. What proportion of school districts is not in compliance with the concussion law?

5. What are the deficits in knowledge and what are the strengths of school superintendents and principals regarding the New Jersey concussion law?

Chapter 4 Methodology

Participants

A survey was e-mailed to 603 current high school superintendents in New Jersey. A superintendent is operationally defined as any person who supervises or oversees a school district. The survey was also sent to 485 high school principals. A principal is operationally defined as any person who oversees a particular school and is responsible for setting school policies and goals and for budget maintenance. The subjects were recruited with the help of the Brain Injury Alliance of New Jersey, a non-profit organization that provides an alliance for people with brain injury; it provides support systems, as well to professionals and provides brain injury advocacy and education to the public.

The inclusion criteria for this study are:

1. Individuals identified by the New Jersey Board of Education as superintendents or principals.
2. Principals and superintendents with a minimum of a Masters degree.
3. Principals and superintendents with a minimum of 3 months experience in their respective roles at the time of the study.
4. Superintendents from public school districts with an interscholastic sports program
5. High school principals (grades 9 through12) from public school districts with an interscholastic sports program.

The exclusion criteria for this study are:

1. Principals and Superintendents in public school districts that do not have interscholastic sport teams.
2. Charter school and parochial schools.
3. Superintendents and principals with less than 3 months experience.
4. Principals of elementary and middle schools.

Materials

The Survey of Attitudes and Knowledge Regarding the New Jersey Concussion Law was created to better understand the self-perceived attitudes and knowledge of superintendents and principals in New Jersey school districts. This survey was created specifically for the purpose of this study. The following sections will be included in the survey: knowledge of concussions, attitudes regarding concussions, knowledge of the concussion law and demographic and background information. Responses were measured, using a Likert scale and multiple-choice options. This survey will have two equivalent forms: one for the principals and one for the superintendents.

The survey was adapted from Rosenbaum (2007) and the Athletic Trainers Society of New Jersey (2011). Permission from the authors was granted. All items included in this survey were independently reviewed for relevance, understandability, and clarity of all content domains by a panel of experienced clinical neuropsychologists or psychologists with expertise in concussion. The panel was asked to independently rate and judge items for relevance, understandability and clarity and to determine whether or not each item should be retained as part of the survey. Items with 100% agreement were retained in the survey, and items that received 100% disagreement were omitted. If an

item received at least 67% agreement, the item was rewritten and resubmitted to the panel for further deliberation until 100% agreement was reached (Appendix A). Items retained in the final survey were those that were deemed to be clear, representative, and relevant to the domains of interests.

Design

This study employed a cross-sectional survey design. This method was chosen because it allowed the researcher to examine the attitudes and knowledge of school administrators regarding the New Jersey concussion laws and model policy. The survey method was also used because it is relatively inexpensive and through it the researcher was able to reach a large sample of participants, therefore, increasing the statistical power.

Procedures

Survey Monkey was utilized to administer the survey. Prior to the beginning of the study, the survey items were uploaded to Survey Monkey and sent to 6 individuals (three of whom are the members of the "Expert Committee") in order to ensure that the components of the survey were operating properly. This procedure was also implemented in order to ensure the workability of the survey website. The individuals were asked to provide feedback regarding the ease of use, including, whether or not the survey should be modified due to its length. Depending on feedback, the survey could have been modified; however, the expert panel's feedback indicated that the form of the survey was understandable and clear. They also indicated that all survey items should be retained. After the creation of the survey, an email, including an invitation letter and survey access was sent to school district superintendents and school principals (Appendix B). This letter stated the purpose of the study, which was to explore the participants' levels of attitudes

and knowledge in regard to concussions and the New Jersey concussion law. It was also stated that all data collected will be de-identified. No personal identifiers were used, and survey data was not linked to any of the participants. It also stated that the survey will take approximately 15 to 20 minutes to complete. Participants were also informed that they might opt out of taking the online survey by closing the web browser. Participants were informed that they would have access to the final results because each school district in New Jersey will get a summary of the results. Additionally, results of the survey will be provided to the Brian Injury Alliance of New Jersey to assist with educational interventions. Contact information for the investigator and for the committee chair will be provided to all participants in case of any questions or concerns about the study. The study was also advertised in the New Jersey Association for School Administrators newsletter. An E-mail remainder was sent to the respondent on two separate occasions requesting his or her participation in the study. Four months from the initial date of distribution, the survey results were analyzed for dissertation data. Descriptive and inferential statistics were calculated using SPSS.

Chapter 5: Results

The goals of this study were multifaceted. Therefore, this methodologically blended study utilized both a qualitative and a quantitative approach to analyze some of the data. The primary focus was ascertaining the knowledge and attitudes of educators regarding concussions in high school athletes. Another goal of the study was determining whether or not school districts are in compliance with the NJ Concussion Law. An independent samples *t-test*, Pearson correlation, and item review and examination were used to analyze the data. The dependent variables for this study were knowledge-based proficiency of concussions (causes, symptoms, sequelae) and attitudes about return to play. The independent variable was the role of the educator (superintendents versus principals). In order to analyze the data, the survey results were divided into three primary sections: (1) concussion knowledge; (2) attitudes regarding RTP; and (3) knowledge regarding the concussion law. These sections are discussed in further detail in the following sections.

Demographics

Participant demographics are described in Tables 2 through 6. Means, medians, modes, and frequencies were used to describe key characteristics of the sample. Descriptive statistics were used for the organization and summary of participant data for the overall sample. It is important to note that the participants are considered to be a rather homogenous group, consisting predominantly of Caucasian males with at least 16 years' experience in working as an educator. Because this is a homogenous sample, the results of this study should be interpreted cautiously; the homogeneity limits its generalizability. A total of 145 subjects began the survey; however, 21 participants were

excluded from the study because of not meeting the required inclusion criteria (i.e. school district does not participate in interscholastic sports; not meeting educational requirement, and not having served as a superintendent/ principal for three months). Another 15 participants' data were not analyzed due to incomplete data sets. At the time of data analysis, the data points for 108 participants were analyzed. For the purpose of data analysis, the participants were divided into two groups: superintendents (N=68) and principals (N=40).

Table 2

Age

	%	*n*
24–29	0	0
30–49	28.7	31
50–64	42.6	46
65+	7.4	8
Missing response	21.3	23

Table 3

Gender

	%	*n*
Male	61.1	66
Female	17.6	19
Missing response	21.3	23

Table 4

Ethnicity

	%	*n*
Caucasian	69.4	75
Black, African American	2.8	3
Spanish/Hispanic/Latino	0.9	1
American Indian or Alaska Native	0	0
Asian	0	0
Chinese	3.1	7
Native Hawaiian	0	0
Other Pacific Islander	0	0
Rather not answer	5.6	6
No response	21.3	23

Table 5

Degree Completed

	%	*n*
Degree completed		
Master's Degree	44.4	48
Doctoral Degree	34.3	37
Missing response	21.3	23

Table 6

Years of experience

	%	*n*
Length (years)		
1–5	0.9	1
6–10	0.9	1
11–15	7.4	8
16+	69.4	75
Missing response	21.3	23

Average Scores on Dependent Variables

The average responses on the dependent variables are shown in Tables 7 and 8. In this study, there were several dependent variables. In order to assess the subjects' knowledge, a Concussion Knowledge Index (CKI) was computed. The CKI, which consisted of 18 true/false questions, included knowledge items as well as case scenarios, and a symptom checklist of commonly reported post concussive symptoms. Each of the items consisted of a correct response choice (see appendix C).The correct responses are empirically supported by the literature and were reviewed by an expert panel. The panel consisted of 3 experienced clinical neuropsychologists or psychologists with expertise in concussion. The panel was asked to complete the knowledge section of the survey in order to ensure that the knowledge items will be scored correctly and consistently with the literature in this field. In the analysis, items were recorded; correctly answered items received 1 point and incorrectly answered items received no points. The CKI was derived

by summing the scores for the knowledge items. Scores on the CKI ranged from 0 to 29; higher scores indicate higher levels of knowledge proficiency.

Similarly, in order to assess the subjects' attitudes regarding concussions and RTP decisions, a concussion attitude index (CAI) was derived. The CAI consisted of 19 items on a Likert scale, each with a 6-point Likert scale ranging from strongly disagrees to strongly agrees. The items included attitude indicators as well case scenarios. The subjects received a score between 1 to 6 points on each item, depending on the safety of their responses. A 6-point score was deemed the safest response, and a 1-point response was deemed a very unsafe response. The CAI scores ranged from 19 to 114. Higher scores represented safer attitudes about concussions and RTF decisions.

Research Question 1: Relationships Between Knowledge and Attitudes in Educators

Before testing whether or not a relationship exists between knowledge and attitudes, an independent t-test for independent samples was selected to test whether or not there was a difference in knowledge and attitudes. The CKI and CAI of the educators were compared. No statistical difference was noted between the two groups on the CKI items. In fact, the mean scores were almost identical for superintendents (M=23.51, SD=2.06) and for principals (M=23.14, SD=2.19). The Levenes test comparing the 2 groups was not significant (F = .58, p = .38).

In terms of the educators' attitudes, another t-test was conducted in order to measure the difference in attitudes between the superintendents and the principals. As previously stated, the CAI is composed of scores from Section 3 and 4 (attitudes questions and attitudes scenarios). Participants received 1 to 6 points on each item

depending on the safety of their responses (1 point for a very unsafe response and 6 points for a very safe response). In the concussion attitude section of the survey, in order to ensure consistency of the score, reversed scoring was used on several items (1,4,5,7,9,10,11,12,14,14,17). The mean score for the CAI was 99 (both for principals and superintendents). In terms of attitudes, superintendents (*M*=100.6, *SD*=13.9) displayed safer attitudes than principals (*M*=98.3, *SD*=5.6). The observed $t(62) = 2.2$ ($p < 0.31$) was significant, indicating that superintendents had safer attitudes toward RTP than principals. It was hypothesized that superintendents would have safer attitudes regarding RTP due to the fact that it is the responsibility of the superintendent to implement a model policy consistent with the NJ Concussion Law. Furthermore, superintendents are ultimately responsible for the well-being of the student athlete; therefore, they are more likely to be sued.

Table 7
Means and Standard Deviations

	Concussion knowledge Index			Concussion Attitude Index		
Group	M	SD	*n*	M	SD	*n*
Educator's role						
Superintendents	23.5	2.06	67	100.6	13.9	67
Principals	23.1	2.19	40	98.3	5.6	40

Note. Scores on the concussion knowledge index range from 0 to 29. Scores on the concussion Attitude Index measure range from 19 to 114.

Table 8

Group Statistics

Group	Mean	Median	Mode
Dependent Variable			
CKI	23.37	23	24
CAI	99.7	101	104

A Pearson correlation was conducted in order to ascertain whether or not a relationship existed between the CKI and CAI. No relationship was found between the two variables Pearson's r (107) =0.12, p >.05. It was hypothesized that the CKI and the CAI would be correlated. As in similar studies, it was predicted that safer attitudes would be correlated with increased knowledge. This finding will be explained in the discussion section.

Research Question 2: **Relationship Between Knowledge of Educators and their Attitudes Regarding Return to Play**

A Pearson product moment correlation was selected to test the second hypothesis, with the variables being the CKI and items that were deemed to be related to the educators' decisions regarding return to play. A negative correlation Pearson's r (107) = -2.1, p <.023was found between the CKI and item 34, "Most other superintendents believe that Athlete A should have returned to play during the semifinal playoff game."

Even though it was presumed that CKI would correlate with RTP decisions, educators were more likely to state that the athlete should have returned to play during an important game.

Research Question 3: Knowledge Deficits and Strengths of Educators

In order to ascertain the educator's knowledge regarding concussions, the author used frequencies of responses to determine percentages and item difficulties. The CKI items were divided into three categories based on the percentages of correctly answered items by the respondents (both superintendents and principals). The categories ranged from low difficulty and moderate difficulty to high difficulty. The groupings were divided by the percentages of respondents who answered the item correctly. Cluster 1 contained items of low difficulty, as evidenced by 80% of the educators answering it correctly. Similarly, Cluster 2 contained items of moderate difficulty, as evidenced by the fact that at least 65% of the respondents answered the items correctly. Finally, Cluster 3 contained items of high difficulty and nearly 50% of the respondents answered the item correctly. The item review is relatively similar to the factor analysis that was conducted in the dissertation of Rosenbaum (2007). Based on the item review, it appears that educators were most knowledgeable regarding the somatic symptomology of concussions; however, they had the greatest difficulty with understanding the role that unconsciousness plays in concussion. Educators also displayed lower levels of knowledge on the diagnosis of concussions (i.e., the role of x-rays, MRIs, etc.).

Items review and examination were also conducted on the post-concussive symptomology. The respondents were asked to identify the most common symptoms associated with concussions. Please see Table 10. It appears that participants were most

knowledgeable regarding the physical symptoms of concussions; however, they were not as knowledgeable regarding the emotional and psychological sequelae associated with concussions. Particularly, 87% of participants incorrectly identified difficulty speaking as a symptom of concussion. Conversely, only 42.5% of respondents identified the individual's exhibiting a short fuse following a concussion.

Table 9

Item review and examination

Low Difficulty	**Moderate Difficulty**	**High Difficulty**
There is a possible risk of death if a second concussion occurs before the first one has resolved. (100%)	If you receive one concussion, you will experience academic problems, even if you never had a concussion before. (65%)	After a concussion occurs, brain imagining (e.g., CT Scans, MRIs, x-rays, etc.) typically shows visible physical damage (e.g., bruise, blood clot) to the brain. (50%)
People who have had one concussion are more likely to have another. (92.5%)	For the majority of student athletes, symptoms of concussion usually resolve completely. (65%)	An athlete who gets knocked out, but wakes up an hour after getting a concussion is experiencing a coma. (57.5%)
In order to be diagnosed with a concussion, you have to be knocked out (i.e., unconscious). (97.5%)	After a concussion, people can forget who they are and not recognize others but function in every other way. (65%)	Being knocked unconscious causes permanent damage to the brain. (57.5%)
A concussion can only occur if there is a direct hit to the head. (97.5%)	A child's brain is more susceptible to concussion than an adult's brain. (77.5%)	
Symptoms of a concussion can last for several weeks. (97.5%)	(Scenario 1) It is likely that player A's concussion will affect his long-term health and well-being. (77.5%)	

Sometimes a second concussion can help a person remember things that were forgotten after the first concussion. (97.5%)

Concussions can sometimes lead to emotional problems. (87.5%)

There are rarely risks of long-term physical and mental health difficulties associated with multiple concussions. (80%)

(Scenario 1). It is likely that player B's concussion will affect his long-term health and well-being. (90%)

(Scenario 2) Even though player A is still experiencing the effects of the concussion, her athletic performance will be the same, as if she had not suffered a concussion. (80%)

*** Reflects the percentages of participants who correctly answered the item.

Table 10

Concussion Symptoms

	% of correctly identified concussion symptoms
Concussion Symptoms	
Headaches	95
Sensitivity to light	95
Difficulty remembering	95
Drowsiness	80
Easily fatigued	82.5
Irritability	82.5
Feeling in a fog	92.5
Feeling slowed down	82.5
Difficulty concentrating	95
Dizziness	92.5
Panic attack	42.5
Short fuse	42.5

Research Question 4: Compliance with the New Jersey Concussion Law

It was hypothesized that a majority of the New Jersey school districts would not be in compliance with the law. A total of 87% of the respondents indicated that their school boards had formally adopted a concussion policy; conversely, 13% of the respondents indicated that as of the current academic year (2012-2013), the school district has yet to adapt a model policy. After further analysis, it was revealed that even

though 87% of the participants indicated that they were in compliance with the law, it appeared that only 40% of the school districts were in full compliance, as defined by the law. For example, some school districts do not have an educational program or a definition of the person who is trained in the management of sports concussions. (See Table 11).

Table 11

Components of the NJ Concussion Law

Component	%	*n*
Trained in the management of concussion	77	57
Definition of Asymptomatic	75.7	56
Who needs to be trained in management of concussions	93.2	69
Graduated return to play	59.5	44
Acceptable education for continuing education	32.4	24
Identification of a healthcare professional who is trained in the management of concussions	76.7	56

As seen from this table, it is evident that even though educators indicated that they have adopted a concussion policy, many of those policies do not meet the full criteria of the concussion law. It is important to note that 93% of educators indicated that their policies define who needs to be trained in the management of concussions (i.e., coaches, athletic trainers, nurses, etc.). However, only 32% of those policies indicate what constitutes an acceptable education for continuing education. Furthermore, it is also

important to note that approximately 40% of the respondents indicated that their policies do not define what *graduated return to play* means. This could present several challenges, such as a lack of uniformity amongst schools in the school district; this could lead to increased rates of concussions and the potential for long-term implications in the academic and emotional domains.

Research Question 5: Knowledge Deficits and Strength of Educators Regarding the NJ Concussion Law

In order to ascertain the knowledge strengths and deficits of the educators, an item review and examination was again conducted. 92% of superintendents indicated that they were involved in the development of the policy; in contrast, 47% of principals indicated that they were involved in the development of the policy. This finding was expected because creations of policies are often subsumed in the job description of a superintendent. Based on the item analysis, it appears that many school districts rely upon the athletic trainer to keep track of athletes who suffer from concussion and to ensure that concussion training has occurred. It perhaps most interesting, that nearly 100% of respondents reported that in their opinions, their school districts are following the adopted concussion policy. This finding is particularly interesting because respondents were confident that their school districts were in compliance. However, most school districts were not in compliance with the concussion law.

As previously reported, 13% of educators indicated that as of the current academic year (2012–2013), they still do not have a concussion policy. Further analysis revealed that of that group, 27.5% of educators reported that they have no plan in place for the development and implementation of a concussion policy for the next academic

year (2013–2014). This finding is noteworthy because it states that school districts were out of compliance almost two years after the concussion law had been mandated. The respondents indicated that they were likely to seek help with the implementation from the NJ School Board Association and from the Brain Injury Alliance of New Jersey (BIANJ). Furthermore, educators indicated that the primary barriers for implementing the law were resistance from parents, budgetary limitations, and insufficient education of and training in the law.

Chapter 6: Discussion

Summary of Findings

It was hypothesized that knowledge-based proficiency in concussions would be greater in superintendents than it would be in principals. This hypothesis was not supported during statistical analysis and, in fact, the means for the CKI were nearly identical. Conversely, it was hypothesized that superintendents would have safer attitudes regarding concussion management and return to play as opposed to principals. This hypothesis was supported. It is presumed that superintendents displayed safer attitudes because they were responsible for the formation of the policy and, ultimately, the well-being of the student athletes. Furthermore, in the case of lawsuits, superintendents would be presumed as most liable. It was also hypothesized that most NJ school districts would not be compliant with the concussion law, which was supported by the analysis. The lack of compliance was due to the law's recent passage, lack of resources, and lack of educational programming for educators. In addition, lack of uniformity among school districts in terms of student population and the lack of operational definitions in the law could contribute to various difficulties in being complaint with the law. For example, currently, the law does not specify the type of education that school personnel should receive in terms of concussion management.

Significance

The findings of this study are significant because they support the fact that educators are becoming more knowledgeable about concussions and are displaying safer attitudes regarding return to play decisions than in previous years. This is the first study that evaluated superintendents' and principals' knowledge proficiency regarding

concussions and their attitudes regarding return to play. Additionally, this is the first study that examined New Jersey school district compliance with the concussion law.

Ponsford et al. (2002) indicated that education regarding concussion symptomology and return to play is an essential component in any concussion intervention program. In their study, the author concluded that athletes who receive educational programming had lower rates of PCS. Similarly, in this study it was found that knowledge regarding concussions is increasing, particularly in the area of somatic symptom recognition. The knowledge base is similar in superintendents and principals. It was hypothesized that superintendents would be more knowledgeable regarding concussions. In terms of knowledge proficiency, educators were more knowledgeable about the somatic symptoms of concussions such as headaches and dizziness. Conversely, they were not as knowledgeable about the psychological sequelae of concussions, such as the concussed person's exhibiting a short fuse. This finding is consistent with the work of Framer and Johnson-Geraded (1997) that found that teachers were not as well educated about the potential emotional sequalae such as difficulty in controlling anger. However it is important to note that educators were most knowledgeable regarding cognitive symptomology associated with concussions such as difficulty concentrating and memory problems. It is assumed that the educators are more knowledgeable about the somatic symptoms because many educational programs tend to focus on the hallmark symptoms of concussions, which tend to be associated with somatic symptomology such as loss of balance and dizziness (Collins & Lovell, 2010). Furthermore, it is hypothesized that educators were more knowledgeable about the somatic symptomology because that media attention tends to focus on that cluster of

symptoms. Finally, another reason why educators were more knowledgeable about the somatic symptoms could be that superintendents and principals tend to deal with the student athletes immediately following the student athlete's sustaining an injury as opposed to following the progression of symptoms throughout the academic year. It is plausible to assume that teachers would be more knowledgeable about the emotional sequelae of a concussion. The results of this study are highly suggestive of the fact that concussion management workshops should be geared towards the recognition of all domains related to concussion: somatic, cognitive, emotional, and sleep dysregulation (Reddy, 2011).

Through analysis of the data, it became evident that the educators' knowledge base was weakest in the domains of diagnosis and the role that unconsciousness plays in concussions. It is important to note that experts in the field tend to disagree on the role that unconsciousness plays in the diagnosis of concussions. In the past, losing consciousness was a hallmark symptom of concussions. However, as the breadth of concussion research increases, it is now clear that unconsciousness is not a prerequisite. Furthermore, as the concussion literature and knowledge base changes and expands, this may, in turn, inform treatment recommendations and accommodations. In order to better treat the student athlete and decrease the long-term effects of concussions, it is important for educators, mental health, and medical professionals to recognize the overlay and interconnections among concussive symptoms. For example, sleep dysregulation could cause difficulty in the athlete's ability to function in an academic setting, which subsequently could decrease frustration tolerance and/or increase feelings of depression.

Therefore, a thorough evaluation of all concussion symptomology should be considered prior to the athlete's resuming his/her normal activities (Reddy, 2011; Perlis et al., 1997).

In terms of attitudes regarding RTP decisions, this study found that educators displayed safe attitudes regarding return to play; however, educators indicated that they were more likely to let an athlete return to play during an important game (semi-final, championship). One explanation for this finding could be that RTP decisions are frequently based on subjective perceptions rather than on objective measures; there is a lack of uniformity in the field regarding the resolution of concussion symptoms (Cantu, 1988; Theye & Mueller, 2004) The decision for clearing an athlete should be weighed carefully because if the symptoms are not fully resolved, the concussive symptoms could be exacerbated and the athletes would be at a greater risk for SIS and CTE (Bailes & Cantu, 2002). Furthermore, one of the findings of this study indicated that there is an inverse relationship between the CKI and item #34. This finding is substantial because it indicates a negative relationship between educators' knowledge and safe attitudes. This is significant because it reveals the fact that increases in knowledge do not necessitate safer attitudes. Ultimately, safe attitudes tend to lead to safe decisions, which in turn could impact the student athlete both in the short and in the long term. It is the author's assumption that educators are more likely to display less safe attitudes because of the potential financial gains and prestige that are associated with playoffs and championship games. This study also found that educators were more likely to state that they have safer attitudes than do their peers. It is hypothesized that subjects are likely to answer in such a manner because they are not going to be judged; this then shifts the locus of control from

them to their peers. It is believed that as a result of the shift in the locus of control, the educators were more likely to report their "honest" feelings.

Relationship to Previous Works

Although no studies were found to compare superintendents' and principals' knowledge and attitudes about concussions and the NJ Concussion Law, research has been conducted with athletes, athletic trainers, and families of individuals diagnosed with TBI. Hux et al. (2006) found that the general population lacks understanding in the area of causes, signs, and sequelae of TBI. However, the general population was developing an understanding that TBI can occur without sustaining an injury to the head or losing consciousness. Similar to this study, the current study found that educators displayed proficient knowledge in the area of causes and signs; conversely, their knowledge was deficient in the area of sequelae of concussion, particularly pertaining to the emotional and psychological domains. The current study seeks to reaffirm the findings of Framer and Johnson-Gerard (1997), who stated that teachers displayed knowledge deficiencies regarding potential problems with anger management, the process of emergence from a coma, and increased likelihood of future injuries. As far as this author knows, this is the first study that sought to evaluate the knowledge of educators regarding the New Jersey Concussion Law. The most significant finding reflects that 13% of school districts are still not in compliance with the concussion law almost three years after it has been enacted. Of the school districts that have adopted a model policy, 60% are not in compliance because they have not met the full criteria of the law.

Relevance to the Theory and Practice of Psychology

This study is relevant to the theory and practice of psychology because psychologists serve on interdisciplinary treatment teams for student athletes who are diagnosed with concussions. Psychologists working with student athletes often must help students to modify their thinking patterns because many athletes display dangerous attitudes regarding RTP. Furthermore, in some areas, a psychologist or a neuropsychologist can determine whether or not a player can return to play. It is essential that the psychologist is well-versed in the literature and is proficient in many areas including, but not limited to: causes, symptoms, sequelae (somatic and emotional), rate of recovery, and the rehabilitation process.

Psychologists in interdisciplinary treatment settings can serve as advocates and increase collaborative efforts among the professions. The numbers of sports concussions are increasing and the long-term implications of concussions are being investigated and reported; therefore, educators, psychologists, and all staff involved with the student athlete are encouraged to gain competence in those areas as this issue becomes more prevalent. Furthermore, concussions frequently affect different domains in the area of daily functioning. A concussed player may experience emotional, somatic, and learning disturbances as a result of the injury. Many student athletes often define themselves in terms of their exceptional skills and talent levels; it is plausible to think that psychological interventions would be warranted in order to identify and modify the thought patterns of the athlete who is not ready to return to the playing field. Furthermore, a psychologist could teach the student athlete a variety of relaxation techniques as well as coping skills. The role of a psychologist could be defined by the

fact that the psychologist ascertains data regarding the sequelae of TBI with the help of empirically supported tests. For example, if a concussed student athlete is displaying difficulty responding to stimuli, a psychologist may opt to conduct a psychological battery that would encompass testing for PCS as well as other tests.

Similar to the athletes returning to play, special consideration should be paid to athletes returning to school and adjusting to everyday activities. As indicated previously, concussed student athletes continue to exhibit lingering symptomology in the form of sleep disturbances, emotional difficulties, and learning difficulties (Reddy, 2011). It is essential that a concussed student athlete is slowly incorporated into classroom activities. It is important that educators focus on meeting the student's academic demands without exacerbating concussion symptomology (McGrath, 2010). The Nationwide Children's Hospital (2003) proposed a gradual return to school which consists of five stages: (1) no school; (2) partial school attendance; (3) full-day attendance with accommodations; (4) full-day attendance without accommodations; (5) full school and extracurricular involvement. Educators should remember that returning to play and returning to school have fluid boundaries and that setbacks could occur. During those times, it is particularly imperative for educators to recognize the struggle of the student and to help decrease escalations of symptoms.

Implications

The findings of this study imply the need for additional education regarding concussion management. It is important to note that even though educators demonstrated knowledge proficiency in the areas of the recognition of symptomology as well as causes, educators still display knowledge deficits in the area of diagnosis as well as of the

sequelae of TBI. Considering the high likelihood of working with student athletes, schools and school districts must foster objective and skilled educators. As concussion rates increase, knowledge competency for concussions must increase to meet the demands of the patient's body with this diagnosis. Furthermore, it is important to be vigilant regarding sports concussions because children's brains are more susceptible to brain trauma (Webbe & Barth, 2003). Thus, they are more likely to experience recurrent concussions (Iverson, 1999). Recurrent concussions could lead to long-term consequences such as personality changes, and/or learning difficulties, which in turn could impede the athlete's quality of life (Iverson, Lovell, & Smith, 2000).

Additional workshops and continuing education may serve to improve knowledge about concussions among educators. It is important to remember that the educational system in the US works with a multi-systemic approach which facilitates the interdisciplinary cooperation of many units. It is imperative that all disciplines working with student athletes be informed of concussions and the long-term repercussions that could result. Collaboration and communication among all interdisciplinary members are essential in order to facilitate a successful and seamless recovery, both academically and on the playing field.

In Simmonds's dissertation (2005), one third of athletes reported that it is acceptable to wait until the end of the game to report a concussion. Results of the current study highlight the importance of recognizing and managing concussions by school professionals. Repercussions due to a lack of knowledge about the diagnosis and about how to treat/accommodate those affected by the injury could involve worsening of symptoms, lagging in academic and social achievements, prolonged treatment times, and

malpractice risks. Additionally, the result of this study highlights the phenomenon of diffusion of social responsibility. Both educator groups are looking at other groups to implement the law. Currently, there is no "gatekeeper" of information regarding concussion. There appears to be a lack of ownership and of accepting responsibility not only for initiating a concussion policy but also for adhering to it. As previously stated, educators are operating with a false sense of hope that each one's school district's concussion policy is in compliance with the NJ concussion law; in turn, this could open the school district to lawsuits as well as negatively impact the student athletes in the short and the long term.

It is important to note that educators are becoming more knowledgeable and they should be commended for that, because the NJ concussion law does not require principals and superintendents to be educated regarding concussions. However, as the results of this study indicate, the principals' buy-in is questionable because they displayed fewer safe attitudes than the superintendents. This could be due to the fact that many principals indicated that they were not consulted on the implementation of the law. This finding highlights a deficient area within the school system. Even though the superintendents created the model policy, it is assumed that the principal's job is to implement the model policy. Therefore, it is essential that superintendents and principals communicate with one another and present a united front to parents, athletes, athletic trainers and other groups involved in the student athlete's life.

Academic workshops and continuing education opportunities must focus on the attitudes of educators working with concussed athletes. It is recommended that during these educational opportunities, educators be provided with case scenarios that would

allow them to reflect on any biases that they may experience. For example, many educators display safe attitudes regarding concussions and RTP. However, one must wonder whether an educator is more likely to display less safe attitudes when a championship game is being decided or scholarships are being handed out. It is important for educators to process their reactions in a collaborative manner rather than in a punitive one. Educators should be given the opportunity to reflect on personal diversity issues and seek consultation or supervision as necessary for appropriate and objective treatment of the student athlete. It is important that all treatment interventions should be tailored to the student athletes and to their presenting symptomology.

Explanations for Unexpected Findings

It was hypothesized that educators' knowledge would correlate with safer attitudes; this is similar to the Sefton (2003), asserting that higher knowledge levels in athletes correlated with increased reporting of concussions, but deficiencies in knowledge were associated with unsafe attitudes and earlier RTP.

A review of psychology and medical literature indicated that increased knowledge would lead to safer attitudes. For example, in the medical literature, improved knowledge increased safer attitudes in adolescents, which consequently decreased sexually transmitted diseases as well as teen pregnancy (Kirby, 2002; Kirby, Larris, & Rolleri, 2007). In this study, no such significant correlation was found. Both superintendents and principals appeared to be knowledgeable about concussions and displayed safer attitudes. It is hypothesized that in this study no correlation existed because of a relative shortage of within-group variability in knowledge and attitudes (Rosenbaum, 2007). The findings of this study reveal a relative consistency of scores and lack of variability in performance.

In order for a correlational analysis to explain the relationship between the variables, satisfactory variability needs to be established. However, as previously stated, in this study, within-group variability was insufficient, which could have contributed to the fact that a correlation was not found. In Rosenbaum's (2007) dissertation, the author also found no correlation between the CKI and CAI of athletes, athletic directors, and trainers. The author reported that the lack of correlation was due to a lack of within-group variability, which is similar to this study. Rosenbaum explained his result by stating that the "binary nature (true/false) of the knowledge items produced a forced response in a homogenous report, which therefore led to a reduction in variability of responses" (p.164). Therefore, it is hypothesized that if the survey items were changed to allow more variability in responses, it is possible that within-groups correlation would be found.

It was also hypothesized that superintendents would be more knowledgeable than principals about concussions. Surprisingly, the mean scores for both educator groups were almost identical. Even though it was presumed that the superintendents would be more knowledgeable, it is assumed that because of continuing education, professional workshops, and medical attentions, principals as well as the general population are becoming increasingly more cognizant of concussions and their sequelae.

Advocacy Implications

Current findings support collaborative relationships between school districts in New Jersey and organizations such as the BIANJ to facilitate and provide education and guidance on how to comply with the new concussion law. The BIANJ and the School Board Association were informed about the results of this study and it is recommended that both organizations provide school districts with workshops that are aimed at helping

the districts become compliant with the law. In addition, the issue of concussion is becoming more relevant and prevalent, and these findings may be helpful for other states seeking to implement similar laws by identifying specific components of the concussion legislation that are or are not being implemented. Therefore, other states would be able to direct their resources accordingly. Results of the study may encourage school districts to create a model policy that would make the health of the student athlete the first priority by offering psychological education classes to parents, athletic trainers, nurses, and the athletes themselves. In addition, the results of the survey may also help in the future training given to school superintendents, principals, athletic trainers, school nurses, parents, and student athletes by providing education to these groups regarding symptoms of concussions, the treatment of concussions, or in the return-to-play guidelines.

The author of this study proposes a training educational program that is co-sponsored by the Brain Injury Alliance of New Jersey (BIANJ) and the New Jersey Board of Education which is unified, inclusive, and geared towards educators at all 603 school districts in New Jersey. The training program should include the following modules: (A) understanding what concussion is; (B) recognizing concussion symptomology that encompasses all domains (emotional, learning, somatic, sleep); (C) understanding potential consequences associated with concussion such as PCS and SIS, CTE; (D) removal of players; (E) return to play; (E) attitudes regarding return to play; (F) return to school; (G) role of educators (superintendents and principals); (H) liability of the school district; (I) commitment to put the athlete's well-being first; and (G) prevention of concussion. The workshops should involve didactic presentation as well as case scenarios, role-playing and an honest discussion regarding the temptation of

returning an athlete to play prior to the resolution of his/her symptoms. It would also be recommended that educators be exposed to a presentation of a standardized concussed athlete. For example, an actor/actress would portray an athlete with concussion symptomology and the educators would have to ask questions pertaining to the occurrence of the injury, the symptoms, the symptom sequelae, possible accommodations/modification, and whether or not the student athlete should return to play.

Limitations

The study utilized survey data to explore the attitudes and knowledge of school superintendents and principals regarding the New Jersey Concussion Law. Although the study yielded beneficial findings, it is important to note several factors that limit the generalizability of the results of this study. The results may not be generalizable to other states because only New Jersey superintendents and principals were surveyed. Because the law was implemented two years ago, it is also believed that the New Jersey educators have received some education regarding the concussion law, and therefore the results may be skewed. The sample population is biased to some degree because principals from elementary and middle schools were excluded from the study.

Another potential limitation of this study is the fact that the study employed a survey method in which school superintendents and principals expressed their attitudes and beliefs while responding to a questionnaire. The extent to which these expressed perceptions and beliefs reflect their actual attitudes about the concussion law cannot be ascertained. Some superintendents and principals may not candidly answer the survey because of concerns that the answers will be perceived as their non compliance with the

law, and they could be afraid of the negative consequences. In addition, due to the recent passage of the law, some superintendents and principals may not be as well educated as others about the concussion law or more importantly, about his or her district's policy. Therefore, they may have elected to not participate in the survey. This is believed to be part of the reason for the low response rate (9.9%).

Because of these reasons, there are opportunities for sample bias that included having only those respondents with a greater interest in or knowledge of the topic returning the survey, and difficulties inherent in self-report such as respondents not accurately reflecting their training, knowledge, or current practice. It is important to note that in order to increase response rate and ensure that the response would be de-identified, the researcher does not know which New Jersey educators completed the survey; therefore, it would be difficult to generalize the results. As previously stated, due to the nature of the survey and the response set, there is limited within-groups variability, which made it difficult to ascertain whether or not there were any relationships between the measured variables.

Future Directions

This study may assist with curricula development in educators' training programs, and also may carry implications for practice in school districts and in psychology. Future studies should include other groups crucial to the management of concussions in student athletes, such as athletic trainers, school nurses, pediatricians, parents, and the athletes themselves. It is also important to assess the attitudes and knowledge of these groups because they are responsible for actually implementing the concussion law. Future studies could utilize this survey in the format of a pre-test/post-test format to measure the

attitudes and knowledge of athletes regarding concussions. For example, the athletes would be given the survey prior to the beginning of the school year to measure their knowledge regarding concussions and attitudes regarding the district policy. The athletes would then be educated by the BIANJ regarding assessment of concussions, symptom identification, resolution of symptoms, return to school, and return to play. Consequently, following the educational intervention, the survey would be administered again to measure the student athletes' knowledge and attitudes regarding concussions and policies. This format could also be used in other populations such as parents, teachers, and athletic trainers.

The BIANJ could also design educational programs that might have greater impact, at the level of school administrators. Additionally, future studies should be extended to elementary and middle schools. In order to increase survey response, it is suggested that a telephone pre-screening survey be conducted in order to identify districts that have not yet implemented the law. This information would allow the BIANJ to reach out to those districts and help them create a model policy and thus be in compliance with the law.

It is important to note that the data represented in this study represent a point in time (spring of 2013); replication of this study could be used to measure the progress of educators in the area of knowledge, attitudes, and school district compliance with the law. This could signify a cultural paradigm shift from being reactive to concussions to preventing them from occurring.

This study is relevant to the theory and practice of psychology because the field is theoretically and practically predicated on minimizing harm and providing care to people.

Concussions are medical conditions that have potentially long-lasting implications, potentially hindering the student athlete's ability to manage his/her emotions and his/her ability to learn academic materials. Student athletes would benefit from gradual return to play as well as from psychotherapeutic approaches that are empirically supported.

Summary and Conclusions

The rate of concussions is increasing at an alarming rate. Over the past few years, researchers have tried to understand the causes and the ramifications of concussions. Because of the increasing rate of concussions in high schools, states are trying to become more proactive than reactive when treating concussions. Therefore, many states have implemented concussions laws. Based on this study, educators have increased their knowledge regarding the causes of concussions; however, they still lack an understanding of the emotional sequelae associated with them. As expected, many school districts are not in compliance with the NJ Concussion Law two years after its implementation. As previously stated, a limitation of this study included a small response rate (9.9%). It is hypothesized that educators were weary of participating in this study because school districts are still not in compliance two years after the concussion law have been put into effect. However, the findings of this study should highlight the importance of educational programs regarding concussions for every group involved with the student athlete. Furthermore, the results of this study should be used as legislative advocacy to help fund those educational programs. It is important to note that educators stated that there are many barriers in implementing the law, such as budgetary limitations, staff limitations, and non-uniformity among the 603 school districts. It is recommended that the NJ school board association as well as the BIANJ facilitate workshops for educators regarding

concussions and the NJ Concussion Law, in order to prevent potential long-term ramifications of concussions. The finding of this current study highlights and advocates the need for an integrated evidenced based program that would provide the best available services for the concussed athlete.

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Appendix A

October14, 2012

Dear ,

I am writing to ask you to participate in a survey to regarding your views on concussions and the law. The purpose of the study is to evaluate the knowledge and attitudes of school district superintendents and high school principals regarding the new concussion law in New Jersey and also to identify barriers and challenges in implementing the law. Currently, there is no study that measures the knowledge level of superintendents (principals) in regards to concussion and the concussion law. Currently, the views of educators are unknown at this time; they are very important to assess and examine. It is our hope that with your participation, a more robust and proactive program of concussion education for school administrators could be implemented. Please view this survey as a way for your voice to be heard; together we can work together and ensure that the health of the student athlete is a priority.

As you are aware, in December 2010 the Governor signed legislation mandating that each school district in New Jersey establish a policy for concussion management. The New Jersey Department of Education (DOE) has developed and posted a model policy, training opportunities, and a fact sheet that are available on the DOE website in compliance with the law. New Jersey's school districts were mandated to have developed and implemented a concussion policy by the beginning of the 2011-2012 school year. As a superintendent, (principal) you play an integral part in the athlete's well-being and decision to return to play and integration to school activities.

The following questionnaire will require approximately 20 minutes to complete. There is no compensation for responding nor is there any known risk. If you choose to participate in this project, please answer all questions as honestly as possible and complete the survey as soon as possible; if it all possible, my hope is to have all the data received by May 1st. Participation is strictly voluntary and you may opt out of the survey at any time.

Please be assured that all of your responses will remain confidential. Also, at no time will we be able to track your location or otherwise identify you. A copy of the summarized results will be sent to all superintendents (principals); how helpful this information will be for you is dependent upon the level of participation. Please be assured that your de-identified data will be used only for research purposes.

The results of the survey will be provided to the Brain injury Alliance of New Jersey, which in turn will help school districts identify some of the challenges they are facing and educate them on how to become compliant with the law. We are very hopeful that you would choose to participate in this study, so that we will all be able to work together in order to ensure the safety of the student athletes.

If you have any questions please free to E-mail the principal investigator at Dr. Donald Masey masey1@ptd.net and/ or 717-471-9753.

Your assistance is greatly appreciated

Sincerely,

Einat Katz-DeLong

Appendix B

Einat Katz-DeLong

7/31/2012

Dear Dr.

Thank you for agreeing to be a part of the expert panel for my survey on concussions in student athletes. As you are aware, Dr. Masey is the chair for my dissertation. Please let either of us know if you have any questions.

I would like to provide you with a brief description of my dissertation project. The purpose of the study is to evaluate the knowledge and attitudes of school district superintendents and high school principals regarding the new concussion law in New Jersey and to identify barriers and challenges in implementing the law.

Consequently, I am seeking your help in refining my survey. I am asking you to rate each item for relevance, understandability, and clarity to help me determine whether it should be modified and whether it should be retained in the survey. I also would like your input on whether the items adequately cover and /or represent the universe of attitudes critical to the concussion law. Items with 100% agreement will be retained. If an item receives at least 67% agreement, it will be rewritten and resubmitted to the panel for further consideration until 100% agreement is reached. Please see the attached rating tables and type your answers in the provided chart. Upon completion, please E-mail me the attached chart with your results and comments.

I would like to thank you again for your assistance. Please know that it is greatly appreciated.

Sincerely,

Einat Katz-DeLong

Expert panel coding tables

Name of rater: _____
Form: _____ (superintendents or principals)
Instructions: Please read each item carefully and mark yes or no for relevance, understandability, and clarity in the chart below. Thank you!

Section 1- knowledge of concussions

Item number	Relevance	Understandability	Clarity	Retention of item	Comments
1					
2					
3					
4					
5					
6					
7					
8					
9					
10					
11					
12					
13					
14					
15					
16					
Scenario 1, item 1					
Scenario 1, Item 2					
Scenario 2, item 3					
Symptom checklist					

Section 2- Attitudes regarding concussion

Item number	Relevance	Understandability	Clarity	Retention of item	Comments
1					
2					
3					
4					
5					
6					
7					
8					
Scenario 1, item 9					
Scenario 2, Item 10					
Scenario 2, item 11					
Scenario 2, item 12					
Scenario 3, Item 13					
Scenario 3, item 14					
Scenario 4, item 15					
Scenario 4, item 16					

Section 3- knowledge of concussion law

Item number	Relevance	Understandability	Clarity	Retention of item	Comments
1					
2					
3					
4					
5					
6					
7 (boxes)					
8					
9					
10 (chart)					
11					
12					
13					
14					
15					
16					
17					
18					

Section 4- Demographics

Item number	Relevance	Understandability	Clarity	Retention of item	Comments
1					
2					
3					
4					
5					

Appendix C
Recoding of the data for CKI and CAI

Knowledge sections

Item #	Items	Correct Response	Recoding
4	There is a possible risk of death	True	1=1 2=0
5	Ppl who have had 1 concussion	True	1=1 2=0
6	In order to be diagnosed with a	False	2=1 1=0
7	A concussion can only occur if	False	2=1 1=0
8	Being knocked unconscious	False	2=1 1=0
9	Sx's of concussion can last	True	1=1 2=0
10	Sometimes a 2nd concussion can help a	False	2=1 1=0
11	After a concussion occurs, brain imagining	False	2=1 1=0
12	If you receive one concussion you will	False	2=1 1=0
13	For majority of student athletes	True	1=1 2=0
14	After concussion, ppl can forget who they are	True	1=1 2=0
15	Concussion can sometimes lead	True	1=1 2=0
16	An athlete who gets knocked out but wakes up	False	2=1 1=0
17	There are rarely risks of long term	False	2=1 1=0
18	A child's brain is more susceptible	True	1=1 2=0
19- Scenario 1	It is likely that Player A's concussion	False	2=1 1=0
20	It's likely that player B's concussions	True	1=1 2=0
21 Scenario 2	Even though Player A is still experiencing	False	2=1 1=0

Symptoms

Check off the following signs and symptoms that you believe a student athlete may be likely to experience AFTER a concussion **(1 point for correctly identifying Sx's)**

- ☐ Hives
- ☐ **Headaches**
- ☐ Difficulty speaking
- ☐ Arthritis
- ☐ **Sensitivity to light**
- ☐ **Difficulty remembering**
- ☐ Panic attack
- ☐ **Drowsiness**
- ☐ **Easily fatigued**
- ☐ **Irritability**
- ☐ **Feeling in a Fog**
- ☐ Weight gain
- ☐ **Feeling slowed down**
- ☐ Reduced breathing rate
- ☐ Excessive studying
- ☐ **Difficulty concentrating**
- ☐ **Dizziness**
- ☐ Hair loss
- ☐ **Short fuse**

Attitudes

Number	Items	Safer Response	Recode
1	I would allow students to continue playing	Strongly disagree /disagree	STR.D=6 MOD.DIS=5 Mild DIS=4 MILD AGR=3 MOD AGR=2 STRON AGE=1
2	Coaches need to be cautious	Strongly agree/agree	Strongly Agree= 6 MOD Agree=5 Mild agree=4 MILD disagree=3 MOD DIS=2 STRONGLY DIS=1
3	Protective headgears	Strongly agree/agree	Strongly Agree= 6 MOD Agree=5 Mild agree=4 MILD disagree=3 MOD DIS=2 STRONGLY DIS=1
4	Concussions are less significant than	Strongly disagree/disagree	STR.D=6 MOD.DIS=5 Mild DIS=4 MILD AGR=3 MOD AGR=2 STRON AGE=1
5	Most high school	Strongly disagree/disagree	STR.D=6

	athletes will play professional sports		MOD.DIS=5 MILD DIS=4 MILD AGR=3 MOD AGR=2 STRON AGE=1
6	An athlete who is suspected of sustaining a concussion	Strongly agree/agree	Strongly Agree= 6 MOD Agree=5 MILD agree=4 MILD disagree=3 MOD DIS=2 STRONGLY DIS=1
7	An athlete had the responsibility to return to a	Strongly Disagree/disagree	STR.D=6 MOD.DIS=5 MILD DIS=4 MILD AGR=3 MOD AGR=2 STRON AGE=1
8- scenario 3	The coach made the right decision to Keep player A	Strongly agree/agree	Strongly Agree= 6 MOD Agree=5 MILD agree=4 MILD disagree=3 MOD DIS=2 STRONGLY DIS=1
9- Scenario 4	Athlete A should have returned to play during the 1st game	Strongly Disagree/disagree	STR.D=6 MOD.DIS=5 MILD DIS=4 MILD AGR=3 MOD AGR=2 STRON AGE=1
10	Athlete B should have returned to play during the semi final	Strongly Disagree/disagree	STR.D=6 MOD.DIS=5 MILD DIS=4 MILD AGR=3 MOD AGR=2 STRON AGE=1
11	Both athlete A and B should return to play for the final playoff	Strongly Disagree/disagree	STR.D=6 MOD.DIS=5 MILD DIS=4 MILD AGR=3 MOD AGR=2 STRON AGE=1
12	Most other superintendents believe that Athlete A should have	Strongly Disagree/disagree	STR.D=6 MOD.DIS=5 MILD DIS=4 MILD AGR=3 MOD AGR=2

			STRON AGE=1
13- Scenario 5	The athletic trainer rather than Athlete B	Strongly agree/ agree	Strongly Agree= 6 MOD Agree=5 MILD agree=4 MILD disagree=3 MOD DIS=2 STRONGLY DIS=1
14	The trainer rather than a medical professional trained in concussion	Strongly disagree/disagree	STR.D=6 MOD.DIS=5 MILD DIS=4 MILD AGR=3 MOD AGR=2 STRON AGE=1
15	Most other superintendents believe that the athletic trainer	Strongly agree/agree	Strongly Agree= 6 MOD Agree=5 MILD agree=4 MILD disagree=3 MOD DIS=2 STRONGLY DIS=1
16	Most other superintendents believe that the coach	Strongly Disagree/disagree	STR.D=6 MOD.DIS=5 MILD DIS=4 MILD AGR=3 MOD AGR=2 STRON AGE=1
17	Most other superintendents believe that the trainer, rather than	Strongly Disagree/disagree	STR.D=6 MOD.DIS=5 MILD DIS=4 MILD AGR=3 MOD AGR=2 STRON AGE=1
18- Scenario 6	Athlete A should tell his coach about the SX's	Strongly agree/agree	Strongly Agree= 6 MOD Agree=5 MILD agree=4 MILD disagree=3 MOD DIS=2 STRONGLY DIS=1
19	Most superintendents believe that Athlete A should tell his coach	Strongly agree/agree	Strongly Agree= 6 MOD Agree=5 MILD agree=4 MILD disagree=3 MOD DIS=2 STRONGLY DIS=1